Momentum in the Foreign Exchange Market

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Abstract

This paper investigates the existence of price momentum in the Foreign Exchange market before and after the Global Financial Crisis, by analysing a sample of 18 currency pairs between 2002 and 2013. Using a portfolio formation approach, average spot and excess returns are calculated for investment horizons ranging from one day to one year. Secondly, this paper investigates a possible link between price momentum and the market positioning of speculators by using the US Commodity Futures Trading Commission's Commitments of Traders report. The results suggest that price momentum in the Foreign Exchange market may be most prevalent over shorter time frames of up to one day. The fall in interest rates after the Global Financial Crisis has reduce the returns from momentum over longer time horizons, with these returns being higher for minor or exotic currency pairs. Lastly, changes to the market position of speculators often precedes the movements in the exchange rate over the following weeks, suggesting that speculator's actions may be an indicator of price continuations.

Introduction

Price momentum in financial markets has been the focus of numerous studies since the early 1990s, however remains a noted market anomaly which cannot be explained by standard finance theory. Empirical research has observed the tendency for asset prices that have risen in the past to continue to do so into the future, and that asset prices which have historically fallen will often decline further. This momentum in price changes over time has been found to produce excess risk adjusted returns (Jegadeesh and Titman, 1993, 2001) and has been observed to varying degrees across equity, fixed income, commodity and currency markets.

There has yet to be a generally accepted explanation for why momentum returns exist across asset classes, and why trend following behaviour can be profitable while contradicting the standard efficient market hypothesis. Some research points towards transaction costs or limitations on short selling (Korajczyk & Sadka, 2004), temporary market inefficiency (Menkhoff & Taylor, 2007) or behavioural biases including slow information diffusion (Jegadeesh & Titman, 2001; Chui, Titman, & Wei, 2010). However, none of these explanations can account for the extent to which returns from momentum investing exist in equity markets, and to the greater degree that is observed in currency markets.

In the study of asset price momentum, currency or Foreign Exchange (FX) markets provide a unique perspective with fewer limitations than the more commonly studied equity market. The FX market is the largest financial market with daily transaction volume exceeding USD 5.5 trillion per day[1], providing high levels of liquidity and low transaction costs. Furthermore, the lack of limitations on short selling allows for momentum studies on the FX market to overcome one of the larger hurdles faced by research into price momentum in the equity market.

With the FX market being dominated by larger sophisticated investors, combined with the factors above it becomes much harder to explain the persistence of price momentum in the FX market compared to studies conducted on equity market momentum, and could potentially expose the deeper underlying cause of such a market anomaly.

While the FX market is yet to attain the same asset class status of bond and equity markets, a growing trend is developing amongst industry practitioners who support the case for maintaining an asset allocation to currencies for a well-diversified portfolio. For example, Deutsche Bank, currently the largest FX dealer, has developed a set of tradable currency indexes available to the retail investor which aims to strategically exploit

[1] CLS Bank, July 13 2013.

certain aspects of the currency markets, such as the Deutsche Bank Currency Harvest Index. This index aims to replicate the popular carry trade, buy investing in a basket of high yielding currencies funded by short positions in low yielding currencies[2].

The Deutsche Bank Currency Momentum Index is constructed to systematically evaluate currency pairs that exhibit long term trending behaviour, and generate returns from the price momentum of these pairs. After recognising the segmentation of market participants in the FX market with some reacting to information slower than others, the Deutsche Bank Currency Momentum Index is constructed by ranking the eligible currency pairs[3] by their 12-month spot rate change against the US dollar, and establishing a long (short) position in the three best (worst) performing currencies. The portfolio of currencies is equally weighted, and rebalanced where necessary on a monthly basis.

Between 1980 and 2006, the Deutsche Bank Currency Momentum Index has delivered an average annual excess return of 3%, with Sharpe ratio of 0.35 and reasonable return stability over the long term (Figure 1).

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[2] The DB G10 Carry Index employs a dynamic approach by ranking currencies by their 3-month interest rate each quarter, and establishing long positions in the three highest yielding currencies and short positions in the three lowest yielding currencies.
[3] The pool of currencies consists of the EUR, GBP, CHF, JPY, AUD, NZD, CAD, NOK, and the SEK.

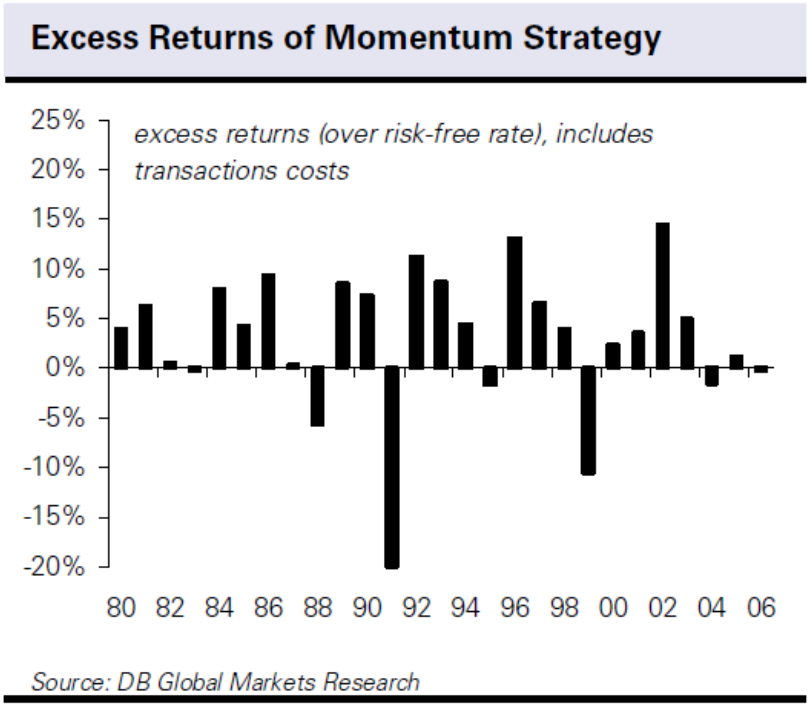

Figure 1 – Deutsche Bank Currency Momentum Index excess returns, 1980 - 2006

This paper aims to build on the previous research covering price momentum in the foreign exchange market by Menkhoff et al (2011). Firstly the impact of the 2008 Global Financial Crisis will be investigated, in order to compare any differences in returns from momentum before and after this event.

While momentum returns in the FX market were high through the 1970s and 1980s, there was a noted decrease in the early 1990s, especially across the major currency pairs such as USD/JPY. The trending behaviour of the major currencies in the 1970s and 1980s turned towards a more range bound behaviour in the 1990s, reflected by a comparative decrease in the

profitability of momentum strategies. While some of this may be due to market participants acting to exploit momentum returns through trend following strategies (Olson, 2004; Neely, Weller and Ulrich, 2009), the macro-economic environment may have played a more important role. For example, the Louvre Accord initiated by policymakers in 1987 made an attempt to stabilize currencies, impacting the FX market heavily in the early 1990s. At the same time the volatility of growth and inflation of economies began to significantly decrease, also acting to dampen the larger trends in the FX market.

With the macro-economic environment having such a profound effect on the FX market, the actions of Central Banks around the world after the 2008 global financial crisis may have caused another significant shift similar to the early 1990s. With interest rates close to zero, monetary policy for the US, UK, Eurozone and Japan has included quantitative easing efforts resulting in an expansion of the monetary base. Such efforts result in the devaluation of currencies, with comparative levels of easing playing a major role in trend generation for exchange rates.

Secondly, this paper will investigate the existence of price momentum over time periods as short as one day. An interesting result from the research by Menkhoff et al (2011) was how excess returns from momentum were greater over shorter time periods, with the highest returns achieved when forming a portfolio based on the exchange rate movements over the prior

month, then holding the portfolio for one month. This research extends the method used by Menkhoff et al (2011) and applies it to daily and weekly exchange rate data.

The final contribution by this paper is to analyse the role which speculators play in driving momentum returns. If momentum returns are largely driven by behavioural biases, as observed by Jegadeesh & Titman (2001) and Menkhoff et al (2011), the observed momentum returns should be correlated with the actions of speculative market participants. From these three contributions, this paper will examine where price momentum may exist in the foreign exchange market, and what factors may be influencing it.

Important Literature

This section reviews the relevant literature surrounding price momentum and its influencing factors. The first section covers research into momentum in equity markets, with the second section covering literature specifically on currency market price momentum. The third section focuses on the 2011 research by Menkhoff et al, which is closely related to this paper. The fourth section outlines the studies around positive feedback investors and predatory trading which may be factors driving momentum returns. The fifth section looks into order flow dynamics and short term

momentum, while the last section covers literature relating to the usefulness of speculative positioning data such as the Commitments of Traders Report.

Momentum in Equity Markets

Research into price momentum in financial markets largely stems from the work of Jegadeesh and Titman (1993), who showed that excess returns from momentum of approximately 1% per month existed in US equity markets between 1965 and 1989. Their method of portfolio formation has been widely applied in later research, and has been the most common method of identifying where momentum may exist from historical prices. Subsequent research by Korajczyk and Sadka (2004) and Conrad and Kaul (1998) supported the findings of Jegadeesh and Titman (1993), showing that widespread excess returns from momentum still existed after adjusting for transaction costs, and were robust across a range of strategies with different investment time spans.

Jegadeesh and Titman (1993) also noted that momentum returns did not persist over extended periods of time, as excess returns after approximately twelve months would either turn negative or not be statistically significant from zero. In addition, momentum returns existed within sub-samples of large cap and small cap stocks, indicating that statistically significant returns from momentum were independent of company size. Lee and

Swaminathan (2000) also investigated price momentum in the US equity market, between 1965 and 1995, and found similar results to Jegadeesh and Titman (1993) with all momentum portfolios producing excess returns that were statistically significant from zero, and which displayed a reversal in returns over a longer investment horizon.

Rouwenhorst (1998) expanded the momentum research from US to European equities, analysing data from 2,190 companies across 12 countries between 1980 and 1995. The findings supported those of studies on the US market, and also found that statistically significant momentum returns existed regardless of the company size. Dijk and Huibers (2002) examined momentum across equities in 15 European countries from 1987 to 1995, and found excess momentum returns existed across all strategies implemented, while De Bondt et al. (1999) showed that, at the very least, momentum returns would out-perform a passive investment strategy for European equities. Research into price momentum in equities in emerging markets and across Asia found lower excess returns than in the US equity market (Rouwenhorst, 1999; Chui et al. 2000), partly influenced by the volatility of momentum returns around the 1997 Asian financial crisis.

Price momentum has been suggested to be the results of a market that only gradually responds to new information. Chan, Jegadeesh and Lakonishok (1996) investigated why a stock's prior 6-month return and its most recent earnings surprise, both publicly available information, helped to predict

the future returns. While price momentum was observed to have a stronger and longer-lasting effect than earnings momentum, both produced statistically significant momentum in returns for at least a six month period. The majority of their evidence was indicative that this price momentum was not reversed in the future, so could not be entirely the result of positive feedback traders. Chan et al. noted that if the market received a piece of news such as earnings that was either above or below expectations, on average the following two news announcements also surprised in the same direction. Analysts were also slow to respond to surprises in news announcements, especially where the announcements opposed the current perception for future returns, and would gradually revise their forecasts over time. Such evidence supports the idea that price momentum may be in part driven by a market that only gradually adjusts to new information. It is important to note that Chan et al. found that stocks with higher momentum tended to have larger trading costs, being smaller less liquid issues.

Griffin, Harris and Topaloglu (2003) found strong evidence of trades following short term historical returns, but with differing behaviour between institutional and individual investors. The day after a strong return performance, stocks in the top decile of returns were found to be 23.9% more likely to be purchased by institutional investors than those in the lowest decile, while individual investors were more likely to sell such

stocks. As such momentum investing is more prevalent for institutional investors compared to individuals it may follow on that the two groups are reacting differently to news announcements, where institutional investors react to positive news as a buy signal while individual investors see such events as a selling opportunity.

Momentum in Currency Markets

Studies analysing price momentum in financial markets have been dominated by research on equity markets, but is expanding into other asset classes including bonds (Gebhardt, Hvidkjaer and Swaminathan, 2005; Jostova et al, 2010) and commodities (Gorton, Hayashi and Rouwenhorst, 2008), which have shown that the price momentum across different asset classes may be driven by common factors. However, research on momentum in the foreign exchange (FX) market has usually focused on factors such as technical trading rules or the carry trade, with only a fewer papers directly addressing the large excess returns seen when employing the methods used in equity momentum research. Okunev and White (2003) and Bianchi et al. (2004) find that excess returns from momentum in the FX market can exceed those seen in equity markets even after adjusting for transaction costs, but may be more predominant with emerging market currencies (Neely and Weller, 2011). This is similar to the finding by Chan et al. (1996) where price momentum in the equity markets was found to be larger amongst smaller, less liquid stocks with larger trading costs.

Okunev and White (2003) suggested that momentum in the foreign exchange market is derived from two main sources: central bank intervention and the presence of noise traders. Noise traders, acting on the historical movements of exchange rates contribute a large proportion of the liquidity in the foreign exchange market and therefore can have a strong influence on the short-term direction of exchange rates. Behavioural finance literature has revealed that such traders are also susceptible to positive feedback mechanisms which can result in market inefficiencies including price momentum. This is driven by the trader's propensity to extrapolate a currency's current observed appreciation or depreciation into their expectations for the short run, creating a bandwagon effect of trend-following (Malkiel 2003).

Exchange rate fluctuations exhibit both positive serial correlation and mean reversion (Levich 1989, Muga and Santamaría 2007). Technical trading rules such as moving averages have been popular amongst traders looking to exploit such aspects of exchange rate dynamics in an attempt to outperform a buy and hold strategy. Meese and Rogoff (1983) showed that macroeconomic fundamentals have a lower explanatory power for exchange rate fluctuations than for fluctuations of stock returns, with a growing body of literature providing evidence on how order flows are heavily related to short-term exchange rate dynamics. Evans and Lyons (2002) observed how transaction flows between market participants can

explain nominal exchange rate movements ranging from a time period of a few minutes up to a couple of months. The influence of order flows is also robust across different currency pairs and different methods of observing the trading dynamics of market participants (Osler 2008; Rime et al. 2010; Sager and Taylor 2008).

Gómez-González and García-Suaza (2012) applied a probabilistic approach for testing the presence of momentum in nominal exchange rates, and found evidence of exchange rate inertia. Using eight emerging market economy currencies paired with the U.S. dollar (Brazil, Chile, Colombia, Hong Kong, Mexico, Peru, South Africa, and Turkey), they applied a logit model to test the probability of obtaining a positive (negative) exchange rate return given a positive (negative) return in the preceding period. In addition, control variables were used to isolate momentum from common drivers of exchange rate movements, such as stock market returns and the associated volatility index (VIX).

Their findings supported the existing evidence that exchange rate momentum is present within the group of emerging market economies, but found an asymmetric presence between exchange rate appreciation and exchange rate depreciation. Evidence of momentum was stronger and more statistically significant during periods of exchange rate deprecation, suggesting that central bank intervention could be an important factor contributing to momentum. While many emerging market economies are

large exporters of commodities they inherently benefit from having lower exchange rates. Hence, during periods of rapid currency appreciation central banks may intervene to actively weaken the currency and also entice traders to short the currency against the U.S. dollar, resulting in momentum from further depreciation in the short term.

Menkhoff et al, Currency Momentum Strategies (2011)

One of the most recent and thorough investigations into price momentum in the FX market was completed by Menkhoff, Sarno, Schmeling and Schrimpf (2011), who found excess returns of up to 10% per annum after an empirical analysis of momentum across 30 exchange rates. Furthermore, their study quantitatively differentiated between returns from momentum and the returns achieved from the carry trade or by following technical trading rules.

Using Reuters 1-month data of exchange rates between January 1976 and January 2010, Menkhoff et al followed a portfolio-formation approach similar to the method used in equity market literature and by industry practitioners when setting up momentum Exchange Traded Funds (ETFs). At the end of each month, a 'long-short' portfolio constructed by going short the six worst performing currency pairs and long the six best-performing currency pairs would formed, with an analysis being conducted on the subsequent return over the holding period. For robustness,

Menkhoff et al formed a number of portfolios using a range of formation and holding periods, identifying currency pairs to go long and short by considering lagged returns over 1,3,6,9 and 12 months and then analysing their performance over a 1,3,6,9 and 12 month period.

The results obtained showed excess returns from momentum existed across all portfolio formation and holding periods, with the portfolios with a one month holding period providing statistically significant excess returns between 6-10% per annum (Figure 2). There was a noted reduction in excess returns for portfolios held over longer periods, with shorter holding periods outperforming longer holding periods for any given formation period. However, the excess returns observed over longer holding periods were still statistically significant indicating that momentum in the FX market may not be confined to shorter time horizons.

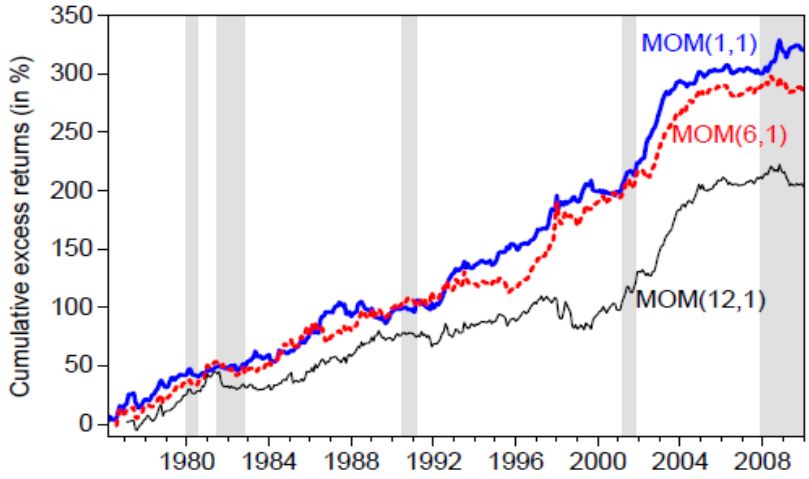

Figure 2: Cumulative excess returns of momentum strategies for portfolios held for 1 month, and formed over 1 month (blue line), 6 months (red line), or 12 months (Black line) –Menkhoff et al (2011)

Different formation periods also impacted on the observed returns from momentum, with portfolios constructed over longer formation periods resulting in lower excess returns than the portfolios constructed over shorter formation periods. For example, Menkhoff et al found returns from momentum of 1.81% per annum for a portfolio formed over a twelve month period and held for twelve months, while a portfolio with a one month formation and holding period produced excess returns of nearly 10% per annum.

One important result from Menkhoff et al showed that excess returns from momentum from the portfolio formation approach should have been exploitable by investors, given that there was stability in returns from a strategy that performed well in the past continuing to do so into the future. It was rarely the case where a portfolio which produced large excess returns in one period would then result in large losses in the following periods, indicating that investors should have had an adequate ability to identify opportunities arising from momentum and subsequently act on it.

Menkhoff et al (2011) also compared the returns from momentum to those of popular technical trading rules and the carry trade, and found a low correlation between the two. Returns from technical trading rules have been studied extensively, with moving averages being one of the most common in literature relating to the FX market. Often such rules entail either 1, 20, 50 or 200 day moving averages where crosses between shorter

and longer period averages are used to generate investing signals. For example, when the 50-day moving average crosses above the 200 day moving average an investor may look to initiate a long position in the asset as prices are seen to be rising. Conversely, if the 50-day moving average crosses below the 200-day moving average an investor may look to initiate a short position. Menkhoff et al computed returns for three moving average crossover rules, and compared their excess returns to those of the momentum portfolios formed over a 1, 6 and 12 month period and held for 1 month. Their regression results found the strongest correlation to have an R^2 value of 26%, with economically and statistically significant intercept estimates. From this, Menkhoff et al concluded that while there was some correlation between momentum returns and the returns from technical trading rules, controlling for returns from a technical trading rule such as a moving average crossover would not account for the excess returns from momentum that were observed.

An important aspect of the FX market is the carry trade, where investors take a long position in a high yielding currency, and fund it by borrowing through a short position in a low yielding currency. Menkhoff et al (2011) also investigated to which extent momentum returns were capturing the returns from such interest rate differentials which underpinned the carry trade, but found that the returns had very little correlation and were structurally different to the returns observed from momentum.

In comparison to the literature on equity markets there has been little work completed on the influence of behavioural effects of investors on currency markets. Jegadeesh and Titman (2001) presented the idea of slow information diffusion leading to an under-reaction by investors, followed by a subsequent over-reaction and reversal which acts as the underlying driver of momentum returns. Menkhoff et al (2011) observes a similar phenomenon to Jegadeesh and Titman (2001) who identify an 'inverted U-shaped pattern' in returns, where returns from momentum increase over a period of several months before dropping off rapidly. Menkhoff et al find a clear pattern of returns increasing over the first 8 – 12 months after a momentum portfolio is formed, before declining in subsequent months. In particular, portfolios with longer formation periods seem to exhibit a more pronounced reversal in momentum returns, mirroring the behaviour observed in equity markets by Jegadeesh and Titman (2001). This result suggests that the momentum observed in equity and currency markets may both be driven by similar behavioural effects, and that momentum across different asset classes may share a common root.

Positive Feedback Investors and Predatory Trading

De Long et al (1990) analysed the dynamics of positive feedback investors who buy assets when prices rise and sell assets when prices fall, often influenced by trend-chasing behaviour or the formation of expectations based on the extrapolation of recent price movements. Rational speculators

are understood to stabilize asset prices (Friedman, 1953) and dampen fluctuations caused by noise traders, however with the presence of positive feedback traders such rational speculators may destabilize asset prices and induce short term price momentum.

For example, a positive news announcement could lead rational speculators to anticipate further buying from positive feedback traders in the market following the price increase of the asset. In order to 'front run' these traders, rational speculators would be willing to bid up the price of the asset beyond what the fundamental news suggests, and sell out at a higher price after the positive feedback traders have entered the market. From this, price momentum can be induced with a proportion of the price increase based on fundamentals with the residual increase from the anticipation of positive feedback traders and their actions in the market. Such price momentum from positive feedback traders is possible over different time horizons, as traders may be acting in response to intraday to monthly or quarterly returns.

De Long et al (1990) notes that front running by investment banks could be a common occurrence of this, where information relating customer orders can provide insight into the future levels of demand.

Brunnermeier and Pedersen (2005) discuss the price impacts of predatory trading, where the knowledge of one trader's requirements to urgently exit

a position may prompt other traders to front-run the selling and drive down prices even further. While this is most pronounced in illiquid markets, such behaviour can lead to short term price momentum that ultimately lead to more traders being drawn in. For example, if it is known that one trader needs to liquidate a position to avoid a margin call, other traders may also sell in advance with the ability to buy back the asset at a lower price. This would lead to prices overshooting to the downside in the short term, and possibly accelerate the sell-off if more traders are forced to liquidate their position from the continued move.

An example of this occurring in the foreign exchange market came in June 1995, where Credit General had bought one billion pound sterling for a client. As this was an unusually large amount to be executed, market participants took note and as Credit General attempted to immediately sell the sterling for Deutsche Mark the price of sterling proceeded to fall rapidly. Jeffery (2003) notes that the risk management for JP Morgan Chase and Deutsche Bank includes dealer exit stress tests, measuring the impact of a forced withdrawal by a rival on the bank's own book.

Order Flow and Short Term Momentum

Technical analysis has proved useful in predicting short-term exchange rate movements, with potential price momentum being identified by various trend analysis techniques (Dooley and Shafer 1984, Levich and

Thomas 1993). Osler (2003) analyses the clustering of buy and sell orders in currency markets around certain levels, which have shown to lead to rapid trend continuation when the price reaches such levels. Pring (1985) identifies potential price support zones where there is a high concentration of demand for an asset, and resistance zones where there is a high concentration of supply. The clustering of orders to buy or sell around these levels results in trends having the tendency to reverse at predictable support or resistance levels, or in the case of substantial demand (supply), rapidly move higher (lower) as the price moves beyond the identified level of resistance (supply). Using available data on currency take-profit and stop-loss orders from a large foreign exchange dealer between August 1999 and April 2000, Olser (2003) notes that take-profit orders tend to be placed at round numbers, while stop-loss orders are concentrated just beyond round numbers.

The implication for price momentum is that in the case where price moves beyond the take-profit orders placed at round numbers, the subsequent execution of stop-loss orders can lead to a continuation of the current trend in the short term. In addition to this, clustering of orders around previous price highs or lows can also lead to further price continuation if the exchange rate breaks to a new high or low and triggers further stop loss orders. It is also important to note that it is common for many traders to only exit or enter a new position if the exchange rate moves above or below

a certain level, and remains there at the end of the day. Such orders based on the previous day's closing price have the potential to contribute to further trend continuation during the following trading session, and may be identified as price momentum. The impact of order clustering and momentum driven by stop-loss dominated order flow can be applied across a range of time horizons, from intraday price dynamics to weekly or monthly exchange rate movements.

Speculative Positioning & the Commitments of Traders Report

Wang (2000) provided empirical evidence of the usefulness of the Commitments of Traders (COT) report provided by the Commodity Futures Trading Commission (CFTC) for forecasting future market movements, where trader positioning was used as to represent market sentiment. Using weekly data dating from January 1993 to March 2000, Wang (2000) focused on six of the most actively traded agricultural futures markets including corn, soybeans, soymeal, wheat, cotton, and world sugar.

The results showed that large speculator sentiment was useful as a price-continuation indicator, and conversely, large hedger sentiment provided a contrarian indicator for the agricultural futures markets. Statistically significant profits were observed when contracts were bought during times when large speculators were extremely bullish and large hedgers were

extremely bearish, and sold when the large speculators were extremely bearish and the large hedgers were extremely bullish.

The contrarian nature of large hedger sentiment forecasting price reversals in the agricultural futures markets is also consistent with the hedging pressure theory that dates back to Keynes (1930) and Hicks (1939), where hedgers that use the futures market to transfer risks they do not wish to bear must pay some level of risk premium to the speculators that take on the risk.

Briese (2004) suggested that COT reports provide similar information to traders to the insider transaction information reported by the Securities and Exchange Commission (SEC): "Commercials are typically value buyers. When their net buying is near its historical top, it is a tip-off that they think bargains are available. When their net position reaches its lower historical boundary, it usually means that they think tulip-mania has gripped a market" (Briese, 1994, p. 20).

Sanders, Boris & Manfredo (2004) also investigated the usefulness of the COT report, this time focusing on the energy futures market. Their analysis employed weekly data for the crude oil, unleaded gasoline, heating oil, and natural gas futures contracts between October 1992 and December 1999

Using Granger causality tests, Sanders, Boris & Manfredo (2004) aimed to determine if a relationship between prices and trader positions exited, but

found insufficient evidence to suggest that the traders net positioning leads market returns and generally did not possess any predictive information. However, the results provided consistent evidence that market returns Granger caused changes in the positioning of traders. Positive market returns resulted in an increase in the net-long position of non-commercial (speculative) traders in the subsequent week, along with a decrease in the net-long position of commercial (hedging) traders, suggesting that speculative traders exhibit a trend following behaviour. This was supported by negative market returns being seen to cause commercial traders to increase their net-long positions while non-commercial traders decreased their net-long position. These findings implied a positive correlation between market returns and positions held by non-commercial (speculative) traders and a negative correlation between returns and commercial (hedging) positions.

The observed trend-following behaviour of speculators is consistent with the findings of Sanders et al. (2000) who analysed the energy futures market using sentiment indices.

The data on trader positioning from the CFTC's Commitments of Traders report was also used by Sanders, Irwin & Merrin (2009) to examine its usefulness for predicting agricultural futures returns from 1995 to 2006. By analysing ten futures markets of variants of wheat, corn, soybean, lean hog, and cattle futures, bivariate Granger causality tests showed very little

evidence that traders' positions were useful in forecasting returns. The authors found weak evidence that for some specific markets commercial positions would lead returns when viewed over weekly horizons. However, their findings clearly showed that trader positions followed returns – non-commercial traders (speculators) increased their long positions after prices rose and vice versa. Such evidence suggests that non-commercial traders can act as trend followers in the agricultural futures market.

Sanders, Irwin & Merrin (2009) noted that usefulness of the CFTC's Commitments of Traders report may be limited in application, due to the delay between the time when the positions are recorded on a Tuesday to when the COT report is published on a Friday. Speculative positions may have an impact on returns when considering periods shorter than a week, as Streeter and Tomek (1992) have argued.

Data

Spot and Forward Rate Data

Historical price data for the period of July 1, 2002 to June 28, 2013 was sourced from Thomson-Reuters (DataStream), and covered 18 currency pairs as outlined in Table 1. Chart 1.1 to Chart 1.18 describe how these currency pairs fluctuated over the sample period. Daily, weekly and monthly observations of the spot exchange rates were collected, along with

the concurrent overnight forward, 1-week forward and 1-month forward rates, and expressed as the amount of foreign currency per 1 US dollar.

The data series employed was the WM/Reuters benchmark rates, which was introduced in 1994 to provide a standardized set of rates to allow for a consistent comparison between portfolios valuations or against other financial benchmarks. The WM/Reuters benchmark rates are calculated at 4pm in London (known as the London fix) from a sample of transactions that occur 30 seconds either side of the fixing time. During this period, the median of the observed bid and offer rates are calculated, with the average of these two rates being reported as the benchmark rate. The WM/Reuters benchmark rates are of high importance from their use in the valuation of financial products, and can often be used by banks as an agreed upon rate for which a client's transaction will occur.

Menkhoff, Sarno, Schmeling and Schrimpf (2011) also used data the WM/Reuters data, but along with a Barclays Bank International (BBI) dataset had monthly spot and forward rate data from 1976 to 2010. Over this period, up to 48 different currency pairs were included in their analysis with the sample size changing depending on which currencies were being traded at the time. In comparison, the dataset in this paper has a consistent sample size with the same number of currencies being analysed from 2002 through to 2013. The 18 currency pairs analysed is smaller than the cross

section of currencies in Menkhoff et al (2011), but represent a wide range of geographic locations and different economies such as those from developed and emerging markets.

Commitments of Traders Data

Data relating to the speculative positioning of US FX Futures traders was sourced from the historical weekly Commitments of Traders (COT) reports published on the US Commodity Futures Trading Commission (CTFC) website.

Using data from the US Commodity Futures Trading Commission (CTFC), the Commitments of Traders (COT) reports provide a weekly breakdown of the open interest and net positioning of US futures market participants. A report is released each Friday at 3:30pm EST, reflecting the commitments of traders for the previous Tuesday. An important feature of the COT report is the ability to separate positioning of commercial and non-commercial (speculative) market participants. When registering with the CTFC, traders are classified as 'commercial' if the trader uses futures contracts for hedging purposes as defined in CFTC Regulations[4]. From

[4] CTFC Regulation 1.3(z), 17 CFR 1.3(z).

this, all the open interest of commercial positioning is backed by a holding of the underlying asset, with trader's use of futures being constantly monitored by the CTFC. Non-commercial positioning represents the contracts held by large speculators, mainly hedge funds and banks trading currency futures with the intention of closing out their position at a profit, before the contract becomes due.

The Commitments of Traders reports provides weekly data on speculative positioning for eight currency pairs (Table 1) for the period of July 10, 2006 to June 24, 2013. While a wide range of positioning data is available, this paper uses the number of outstanding contracts for long and short positions in currency versus the US dollar that are held by non-commercial (speculative) traders on the previous Tuesday. The level of open interest, as well as the net position for the different trader classifications are presented in Chart 2.1 to Chart 2.8 along with the respective exchange rate.

Methodology

This section outlines the method to calculate returns from price momentum over various time horizons, and how the Commitments of Traders report is used to incorporate information on speculative positioning. The first section outlines the portfolio formation approach using daily exchange rate data. The second sections extends the analysis to weekly and monthly

exchange rate data, and explains the subsequent adjustments that are made to the method. The third section outlines how the sample of currency pairs is split into majors and minors & exotics, while the final section explains how spot and excess returns are regressed on lagged changes to the levels of speculative open interest.

Price Momentum: One to Five Days

To investigate price momentum in the foreign exchange market, a method of portfolio formation will be used, similar to that of Menkhoff et al (2011). A US Dollar-neutral portfolio comprising of long and short positions of equal number of currency pairs will be constructed, based on the historical returns of the currency pairs over a given formation period. This portfolio will then be invested for a given holding period, where its return will be recorded.

In order to compare price momentum before and after the Global Financial Crisis (GFC), the dataset of exchange rates will be split into three time periods. First, a holdout period of 1 June 2007 to 31 December 2007 will be extracted to represent the GFC. From this, we are left with a pre-GFC period of 1 June 2002 to 31 May 2007 and a post-GFC period of 1 January 2008 to 28 June 2013. Annualized returns for the momentum portfolios will be compared between the pre-GFC period, the post-GFC period and for the entire dataset (1 June 2002 to 28 June 2013).

From the exchange rate data (denoted as foreign currency units per 1 USD), daily spot and excess returns are calculated as:

Spot Return (r) for holding a long position foreign currency X:

$$r_{t+1}^{X} = s_t^{X} - s_{t+1}^{X}$$

Excess Return (R) for holding a long position foreign currency X:

$$R_{t+1}^{X} = f_t^{X} - s_{t+1}^{X}$$

Given that:

$$R_{t+1}^{X} \equiv i_t^{X} - i_t - \Delta s_{t+1}^{X} \approx f_t^{X} - s_{t+1}^{X}$$

where *s* and *f* denote the log spot and 1-day forward rate respectively. i_t^X represents the interest rate of the foreign currency at time t, while i_t represents the domestic interest rate at time t. The log spot rate change or return over the period is given as Δs. Following this, returns for short positions in the foreign currency are calculated as:

Spot Return (r) for holding a short position foreign currency X:

$$r_{t+1}^{X} = -s_t^{X} + s_{t+1}^{X}$$

Excess Return (R) for holding a short position foreign currency X:

$$R_{t+1}^{X} = -f_t^{X} + s_{t+1}^{X}$$

At the end of each day, the return (spot and excess) for every currency pair over a certain formation period (p) is calculated, and then ranked from highest to lowest according to their performance versus the US dollar. For the analysis of price momentum using daily exchange rate data, we consider formation periods ranging from one to five days, where:

$$p = \{1, 2, 3, 4, 5\}$$

For example, a formation period of p=1 will rank the currencies based on their returns over the previous day, while a formation period of p=4 will rank the currencies based on their previous four day return.

Once the ranking has been established, an equally weighted US Dollar-neutral portfolio of currencies is formed, by taking long positions in the n best performing currencies and a short position in the n worst performing currencies, where:

$$n = \{1, 2, 3\}$$

This portfolio is then invested for a give holding period (q), which similar to the formation period ranges from one to five days:

$$q = \{1, 2, 3, 4, 5\}$$

The total number of different portfolio combinations that are analysed is therefore 75, given that there are five different formation and holding periods, each with portfolios that are long and short one to three currency pairs.

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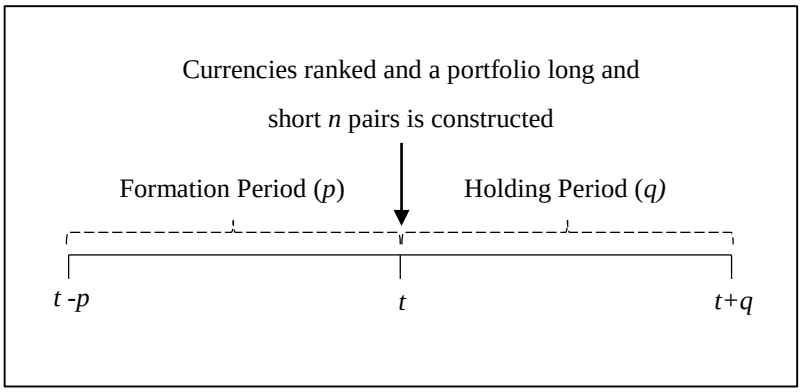

Figure 3 Timeline of portfolio formation, construction and investment.

The holding period returns for all similar portfolios constructed with the same *p*, *q*, and *n* are then averaged and annualized, covering the pre-GFC period, post-GFC period and entire dataset.

Weekly & Monthly Price Momentum

To examine price momentum over greater time horizons the same portfolio formation approach is applied, this time using weekly and monthly exchange rate data. The pre-GFC and post-GFC periods remain the same as in the analysis of the daily exchange rate data.

For the analysis of weekly exchange rate data, the portfolio formation (p) and holding (q) periods now range from one to five weeks each, with the portfolios once again containing long and short positions in one to three currency pairs (n):

$$p = \{1, 2, 3, 4, 5\}$$

$$q = \{1, 2, 3, 4, 5\}$$

$$n = \{1, 2, 3\}$$

An analysis of price momentum using weekly data would require a portfolio to be formed every week on a rolling basis. For example, if the portfolio had $p = 2$, $q = 3$ and $n = 1$, it would take a long position in the best performing currency and a short position in the worst performing currency based on the previous two weeks returns, and report how the portfolio performed over the next three weeks. The returns from all similar portfolios with $p = 2$, $q = 3$ and $n = 1$ formed over the sample period are then averaged and annualized.

At the monthly level, the portfolio formation (p) and holding periods (q) will range from one to twelve months, while the number of long and short positions of currency pairs in a portfolio remains as one to three:

$$p = \{1, 3, 6, 9, 12\}$$

$$q = \{1, 3, 6, 9, 12\}$$

$$n = \{1, 2, 3\}$$

Major Currency Pairs vs. Minors & Exotics

Neely & Weller (2011) found price momentum to be more predominant with emerging market currencies than for the major currency pairs. To allow for a comparison in this analysis, the dataset of currency pairs is divided into the major currency pairs, including commodity currencies, and minors or exotics which are traded in much lower volumes. A full list of the sample of currencies that falls into each of these two categories can be found in Table 2.

For each of the samples of currency pairs, spot and excess returns are calculated using the same portfolio formation approach as before on daily, weekly and monthly exchange rate data. For all of the time horizons, the set of formation (p) and holding (q) periods as well as the number of long and short positions of currency pairs (n) in a portfolio is kept consistent to allow for a comparison to the full sample of currency pairs.

Speculators & Price Momentum

The last step in the analysis of price momentum is to investigate the relationship between movements in the exchange rate and the actions of speculative investors. To do this, weekly spot and excess returns will be regressed against lagged changes to the quantity of contracts outstanding that represent the open interest of speculative market participants from the weekly COT report.

This analysis is conducted using both spot and excess returns calculated based on formation periods ranging from one to five weeks, similar to the portfolio construction method. The number of contracts outstanding that represent the open interest each week are separated into speculative long positions and speculative short positions. Weekly changes to the number of contracts held by speculators long and short are lagged from one to five weeks, and each regressed against the returns of different formation periods. For all of the regressions Newey-West standard errors are calculated with a lag length of two.

Following the previous analysis of price momentum, the sample is also divided into a pre-GFC period of 10 July 2006 to 31 May 2007 and a post-GFC period of 1 January 2008 to 28 June 2013 for comparison.

Results

The results are split into four sections. The first section covers the average spot and excess returns from the daily momentum portfolios, and the differences before and after the GFC. Also, this section examines the results observed across various portfolio formation and holding periods, and for the portfolios containing different numbers of currency pairs. The second section summarises the returns of the weekly and monthly momentum portfolios, and the third section reports the portfolio returns

after dividing the sample of currencies into two groups. The final section contains the regression results examining the relationship between portfolio returns and the COT report.

Daily Price Momentum

The average annualized returns for the momentum portfolios constructed using daily exchange rate data are summarised in Table 3.1 (excess returns) and Table 3.2 (spot returns). Overall, the results show that returns from price momentum decrease as the formation or holding periods increase from one to five days. An average annual excess return of 5.58% is found for a portfolio long and short one currency pair over the whole sample period, with a formation and holding period of one day. As the formation period for such a portfolio increases to five days, the average excess return falls to -3.17%. Likewise, as the holding period increases from one to five days, the average excess returns falls to -0.61%. Increasing the number of currency pairs held in a portfolio often reduces the average excess return, especially for portfolios constructed with shorter formation and holding periods. For example, when looking at the whole sample period the average excess return for a portfolio with a formation and holding period of one day falls from 5.58% to 3.66% when the number of currency pairs held in the portfolio rises from one to three.

Excess returns from momentum were generally higher before the Global Financial Crisis (GFC) than after. A portfolio long and short one currency pair constructed with a formation and holding period of one day had an average excess return of 6.79% before the GFC period compared to 4.32% after. For the portfolios that performed poorly before the GFC, their performance after the GFC often suffered to a greater extent.

There is a distinct outperformance from portfolios constructed with a formation and holding period of one day. As the formation and holding periods increase, average excess returns quickly drop to become closer to zero or even turn negative. This is an important result to note, as it may indicate that momentum returns are being limited to shorter time frames. This observation is robust across the pre-GFC, post-GFC and whole sample periods, and for portfolios containing different numbers of currency pairs.

Table 3.2 summarises the spot returns for portfolios constructed using daily exchange rate data. Compared to the excess returns, the common themes remain the same: portfolios constructed with shorter formation and holding periods and fewer currency pairs tend to outperform, with spot returns decreasing after the GFC. Once again, portfolios constructed with a formation and holding period of one day stand out with the largest positive returns. Portfolios with high excess returns tended to also have even higher spot returns, while those with low or negative excess returns

had even lower spot returns. For example, when considering the whole sample period a portfolio long and short one currency pair constructed with a formation and holding period of one day had an average excess return of 5.58%, but an average spot return of 6.95%. A similar portfolio with a holding period of five days had an average excess return of -3.17% but an average spot return of -4.55%.

Weekly & Monthly Price Momentum

Tables 3.3 and 3.4 summarise the average excess returns and average spot returns for portfolios constructed using weekly exchange rate data. Over the whole sample period, the average excess returns from price momentum were close to zero for portfolios with a formation and holding period of one to five weeks. For these time horizons, the number of currency pairs held in a portfolio did not greatly influence the excess returns. In contrast to the daily momentum portfolios, the portfolios with the shorter formation and holding periods of one week appeared to be the worst performers over the whole sample period.

At the weekly level, there is a clear distinction between average excess returns before and after the GFC. Table 3.3 highlights how all but one portfolio before the GFC had a positive average excess return, while after the GFC every portfolio recorded a negative average excess return. Table 3.4 outlines the spot rate returns for the weekly momentum portfolios. For the whole sample period, average spot returns were generally lower than

their corresponding average excess returns especially for longer formation and holding periods. However, the resounding difference can be seen when comparing average spot returns and average excess returns for the period before the GFC. While all but one portfolio had a positive excess return before the GFC, most of these portfolios had a negative average spot returns. This result highlights the influence which interest rate differentials have on momentum portfolio returns when portfolios are invested over a period of one to five weeks.

The average excess returns for monthly momentum portfolios are summarised in Table 3.5. For the whole sample period, the average excess returns once again close to zero, with the portfolios constructed with shorter formation periods having slightly positive excess returns that turn slightly negative as the formation period increases. The interesting result once again comes when comparing pre-GFC and post-GFC excess returns. Similar to the weekly momentum portfolios, all but one performs worse with a lower average excess return after the GFC with most turning from positive to negative. Table 3.6 summarises the average spot rate returns for the monthly momentum portfolios, and has a similar theme to the spot returns of the weekly momentum portfolios. The positive excess returns in the period before the GFC are almost all negative when considering only pure spot rate changes.

The results of the weekly and monthly momentum portfolios shows how returns from price momentum have fallen after the GFC, and how price momentum for portfolios invested over these longer time horizons are largely influenced by interest rate differentials.

Majors vs. Minors & Exotics

The results from repeating the analysis after splitting the sample of currency pairs between 'majors' and 'minors & exotics' are contained in Table 4.1 through to Table 4.12.

Tables 4.1 and Table 4.2 summarise the annual excess return for daily momentum portfolios consisting of major currency pairs and minors & exotics respectively. When considering the whole sample period from 2002 to 2013, there is little difference between portfolios constructed of only major currency pairs and those constructed of minors & exotics. For both samples, the best performing portfolios are those with lower formation and holding periods.

However, when considering the periods before and after the GFC, distinctions between the majors and minors & exotics start to emerge. Before the GFC, portfolios of only major currency pairs had a higher average excess return, especially for lower formation and holding periods. For example, a portfolio holding a long and short position in one of the major currency pairs constructed from a formation and holding period of

one day would yield an average excess return of 5.73%. A similar portfolio constructed from only minors & exotics would have an average excess return of 4.51%. When considering the sample period after the GFC these results are reversed, with portfolios of minors & exotics outperforming their related portfolios of major currency pairs. This difference is also highlighted to a greater extent as the number of currency pairs held in a portfolio increases, where the difference in average excess returns between similar portfolios of majors and minors & exotics can rise to more than 4.5%. Table 4.3 and Table 4.4 provide a similar summary, this time using spot returns instead of excess returns.

A summary of excess returns and spot returns for weekly momentum portfolios is included from Table 4.5 to Table 4.8. For the whole sample period, spot returns and excess returns are generally higher for portfolios consisting of only minor & exotic currency pairs compared to those limited to major currency pairs. The greatest contract can be seen from the returns in the period before the GFC, where all portfolios of minor & exotic currency pairs have a positive average excess return while all portfolios consisting of major currencies have a negative excess return. The difference between these portfolios can reach close to 10%. For example, a portfolio during that time which is long and short one minor or exotic currency pair, with a formation period of two weeks and a holding period of one week, has an average excess return of 7.15%. A similar portfolio

restricted to only major currency pairs would however have an average excess return of -2.36%. This result is likely to be due to the economies of minor & exotic currency pairs generally having higher interest rates, as the previous results have shown how average returns to weekly momentum portfolios are influenced by interest rate differentials. Average spot returns for the weekly momentum portfolios are summarised in Table 4.7 and Table 4.8.

Finally, the excess and spot returns of monthly momentum portfolios are summarised in Table 4.9 through to 4.12. Over the whole sample period, the average excess and spot returns for portfolios constructed with only major currency pairs tend to slightly outperform, especially for longer formation and holding periods. However, when the average excess returns are compared across the periods before and after the GFC the results are mixed. Prior to the GFC, momentum portfolios constructed from minor & exotic currency pairs outperformed those constructed from only the major currencies. After the GFC this result is reversed, with the portfolios constructed from minor & exotic currencies this time underperforming. This result again shows how changes in interest rate differentials before and after the GFC can impact the performance of momentum portfolios, with minor & exotic currency pairs whose interest rates are generally higher having a greater exposure to this factor.

Speculative Positioning & Price Momentum

The results after regressing excess and spot returns on lagged changes to the level of speculative open interest (quantity of long and short futures outstanding) are summarised in Table 5.1 and Table 5.2. There is a close similarity between the estimates for the regressions using excess returns and spot returns, resulting negligible changes to the level of significance between the two results. This is due to the differences between excess and spot returns being small in comparison to the changes in the quantities of contracts outstanding, which are of a greater order of magnitude.

There are mixed levels of significance for results when considering all formation periods for returns and all lag lengths of changes to the level open interest. However, when considering only those estimates that are significant at the 1% level (denoted by a **), it is commonly found that increases (decreases) in the quantity of long (short) contracts are followed by a positive excess return for the currency pair in the follow weeks. These regressions suggest that when speculative investors are increasing long (short) positions in a currency pair, prices tend to be increasing (decreasing) in the following weeks.

The most significant results tend to come from regressions with shorter lag lengths of changes to open interest levels, and for those with longer formation periods of returns. Secondly, after the GFC the relationship between lagged changes in open interest and excess or spot returns may

have strengthened, with the coefficient estimates becoming more significant that prior to the GFC.

Conclusion

Returns from price momentum in the foreign exchange market are more predominant over shorter time periods. As the results have shown, there is a clear distinction for higher average returns for portfolios with a formation and holding period of one day. This result is an extension of the finding by Menkhoff et al (2011), who observed the highest returns from momentum to come from the portfolios with the shortest formation and holding periods in their analysis.

This result suggests that the key drivers of price momentum can be derived from short term influences. Even after dividing the sample of currencies into majors and minors & exotics, and comparing the periods before and after the Global Financial Crisis, the result remains that there is something unique driving short term price momentum. This phenomenon could be caused by noise traders, as suggested by Okunev and White (2003) and (Malkiel 2003), where they are forming expectations based on extrapolating past price changes and therefore inducing some short term momentum into the exchange rates. Order flow influences, such as those described by Osler (2003) could also be contributing to these short term

returns as well as the behaviour of rational speculators who are looking to 'front run' positive feedback traders (De Long et al, 1990).

With the foreign exchange market being open 24 hours a day from Sunday evening to Friday afternoon[5], there could be a degree of slow information diffusion from news releases that spill over from one trading session to the next. This explanation is in line with the theory put forward by Jegadeesh and Titman (2001) relating to slow information diffusion in equity markets. It is likely that there are a range of short term factors which are combining to produce the distinct returns from portfolios with a formation and holding period of one day, which presents an interesting foundation for future research.

Secondly, the results showed how interest rate differentials can impact the returns of longer term momentum portfolios, specifically those constructed with an investment horizon spanning from weeks to months. After dividing the sample into periods before and after the GFC, it is clear that returns longer term momentum in the foreign exchange market relies on interest rate differentials more than the influences noted for the daily portfolios. The results also show how these momentum returns are more commonly

[5] US time. Trading occurs 24 hours a day from Monday morning in New Zealand through Friday night in New York

found in the minor or exotic currency pairs. Weekly and monthly momentum portfolios performed better when they were constructed using only minor and exotic currency pairs, which supports the findings of Neely and Weller (2011) who found price momentum to be more predominant with emerging market currencies on these time horizons.

Lastly, the speculative positioning data from the Commitments of Traders (COT) report shows a link between the actions of those traders and the future exchange rate movements. With the timing limitations of the data in the COT report, it is hard form theories on causation unless a more frequent dataset can be obtained. However, speculators in the foreign exchange market increase their long positions in a currency prior to periods of positive returns, and vice versa. This result is similar to the finding of Wang (2000) who noted the same speculator sentiment to be a useful price continuation indicator in the agricultural futures markets.

Future Research

The results from this paper open the door for a number of future research opportunities. The first of which should be to investigate price momentum in the foreign exchange market over shorter time horizons. Given the outperformance of momentum portfolios with a formation and holding period of one day, it would be interesting to see if these returns are larger

when considering intra-day returns that might come from using hourly observations of the exchange rates.

Such intra-day momentum could be concentrated around the open or close of key markets, such as when the US, European or Asian trading sessions commence. If slow information diffusion is a key driver of short term momentum, then any exchange rate movements from a news release in one trading session might continue at the start of the next as new traders enter the market. An extension of this would be to investigate the impact that liquidity has on momentum returns. This could be done by comparing price momentum between quiet periods, such as the time between the US session ending and the Asian session starting, and the busier trading sessions such as when both the US and European markets are active.

To assess the practicality of acting on this short term price momentum, it will be important to incorporate some form of risk management into the analysis. Furthermore, filter rules could be applied based on popular technical analysis methods to assess if this improves the performance of momentum return portfolios. If the short term price momentum is a result of noise traders or positive feedback traders, then incorporating some of the popular technical analysis tools (such as moving averages) which they pay the most attention to can help to define exactly when this price momentum exists and increase the average returns for portfolios.

Next, further analysis could be conducted to assess the possibility of a reversal in momentum over short and longer time horizons. This phenomenon has been popular in previous research (Jegadeesh and Titman, 1993; Lee and Swaminathan, 2000). The current portfolio formation approach does not adequately identify if a certain portfolio initially outperforms during the holding period, only to have returns turn negative during the latter portion. Such an effect can result from a currency pair exhibiting some degree of mean reversion, and may have a more profound influence momentum returns over longer time horizons.

Lastly, if a more frequent and timely dataset of speculative trader positioning becomes available, it can be used to investigate a possible causation link between the trading behaviour of speculators and price movements in the underlying asset. While this paper has shown that price momentum does exist in parts of the foreign exchange market, there remains more to be investigated, such as the extent to which behavioural biases play in driving this market anomaly.

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Table 1: Sample of Currency Pairs

Spot & Forward Rate Data	***Speculative Positioning Data***
Australian Dollar (AUD)	Australian Dollar (AUD)
British Pound (GBP)	British Pound (GBP)
Canadian Dollar (CAD)	Canadian Dollar (CAD)
Czech Koruna (CZK)	Euro (EUR)
Danish Krone (DKK)	Japanese Yen (JPY)
Euro (EUR)	Mexican Peso (MXN)
Hong Kong Dollar (HKD)	New Zealand Dollar (NZD)
Hungarian Forint (HUF)	Swiss Franc (CHF)
Japanese Yen (JPY)	
Mexican Peso (MXN)	
New Zealand Dollar (NZD)	
Norwegian Krone (NOK)	
Polish Zloty (PLN)	
Singapore Dollar (SGD)	
South African Rand (ZAR)	
Swedish Krona (SEK)	
Swiss Franc (CHF)	
Turkish Lira (TRY)	

Table 2: Currency Pairs: Majors vs. Minors & Exotics

Majors	***Minors & Exotics***
Australian Dollar (AUD)	Mexican Peso (MXN)
British Pound (GBP)	Norwegian Krone (NOK)
Canadian Dollar (CAD)	Polish Zloty (PLN)
Euro (EUR)	Singapore Dollar (SGD)
Japanese Yen (JPY)	South African Rand (ZAR)
New Zealand Dollar (NZD)	Swedish Krona (SEK)
Swiss Franc (CHF)	Turkish Lira (TRY)
	Czech Koruna (CZK)
	Danish Krone (DKK)
	Hong Kong Dollar (HKD)
	Hungarian Forint (HUF)

Table 3.1: Daily Portfolio – Annualized Percentage Excess Return

Pairs =1

Before GFC

Holding \ Formation	1	2	3	4	5
1	6.79	3.49	-2.96	-4.07	-1.93
2	1.61	1.26	-4.66	-3.86	-2.58
3	-0.25	-1.17	-3.82	-2.93	-1
4	-1.41	-1.15	-3.16	-1	0.29
5	-0.33	-0.68	-2	-0.54	1.34

After GFC

Holding \ Formation	1	2	3	4	5
1	4.32	1.52	1	-3.87	-5.62
2	1.34	-0.71	-2.55	-3.59	-4.02
3	0.38	-1.75	-2.9	-3.16	-4.01
4	-0.73	-2.79	-4.05	-3.75	-3.41
5	-0.97	-3.29	-3.22	-2.94	-3.22

Whole Period

Holding \ Formation	1	2	3	4	5
1	5.58	2.41	-0.16	-3.3	-3.17
2	1.42	0.33	-2.97	-3.66	-3
3	-0.06	-1.36	-3.05	-3.17	-2.54
4	-1	-2.09	-3.35	-2.77	-1.66
5	-0.61	-2.16	-2.63	-2.03	-1.06

Pairs =2

Before GFC

Holding \ Formation	1	2	3	4	5
1	6.18	1.05	-1.46	-2.15	-0.88
2	1.38	-0.99	-3.35	-2.97	-0.78
3	-1.03	-2.28	-3.39	-2.24	-0.34
4	-1.06	-1.4	-2.04	-1.15	0.86
5	-0.76	-0.86	-0.92	-0.46	1.38

After GFC

Holding \ Formation	1	2	3	4	5
1	3.93	1.69	1.83	-1.93	-3.99
2	0.51	-1.15	-0.69	-3.37	-3.85
3	-0.64	-1.92	-2.71	-3.56	-3.33
4	-1.24	-2.92	-3.44	-3.04	-3.27
5	-1.75	-3.25	-2.55	-2.45	-2.97

Whole

Holding \ Formation	1	2	3	4	5
1	5.13	1.87	0.56	-1.61	-2.27
2	1.06	-0.66	-1.62	-3.01	-2.23
3	-0.81	-1.79	-2.9	-2.87	-1.94
4	-0.92	-2.05	-2.71	-2.21	-1.38
5	-1.12	-2.01	-1.89	-1.62	-1

Pairs =3

Before GFC

Holding \ Formation	1	2	3	4	5
1	3.39	0.71	-1.04	-1.97	-1.23
2	0.14	-2.32	-2.52	-2.76	-0.98
3	-1.52	-2.45	-2.46	-1.85	-0.89
4	-1.26	-1.8	-1.46	-1.07	0.12
5	-0.71	-1.06	-0.7	-0.32	0.57

After GFC

Holding \ Formation	1	2	3	4	5
1	3.65	1.39	1.48	-1.03	-2.41
2	0.67	-0.56	-0.35	-2.79	-3.42
3	0.08	-1.12	-2.67	-3.19	-3.18
4	-0.9	-2.35	-3.56	-3.08	-2.89
5	-1.58	-2.64	-3.05	-2.55	-2.52

Whole

Holding \ Formation	1	2	3	4	5
1	3.66	1.56	0.73	-1.02	-1.64
2	0.64	-0.93	-1.03	-2.64	-2.22
3	-0.59	-1.44	-2.4	-2.54	-2.18
4	-0.9	-1.92	-2.46	-2.13	-1.54
5	-1.07	-1.77	-1.96	-1.58	-1.17

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007
Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 3.2: Daily Portfolio – Annualized Percentage Spot Return

Pairs =1

Before GFC

Holding \ Formation	1	2	3	4	5
1	7.89	3.52	-3.13	-4.79	-2.82
2	3.19	0.77	-4.21	-4.87	-2.76
3	0.7	-1.8	-3.57	-2.97	-0.23
4	-0.71	-1.59	-2.54	-1.5	0.92
5	0.12	-1.01	-1.56	-0.68	1.67

After GFC

Holding \ Formation	1	2	3	4	5
1	5.96	1.06	-0.38	-3.03	-7.17
2	2.59	-1.46	-3.42	-3.23	-5.64
3	1.54	-2.52	-3.98	-3.21	-5.63
4	0.67	-3.27	-5.17	-3.72	-5.19
5	0.14	-3.82	-4.47	-2.96	-4.42

Whole

Holding \ Formation	1	2	3	4	5
1	6.95	2.26	-0.96	-3.07	-4.55
2	2.78	-0.12	-3.27	-3.95	-3.98
3	1.08	-2.01	-3.61	-3.21	-3.11
4	0.12	-2.44	-3.72	-2.98	-2.38
5	0.24	-2.47	-3.12	-2.17	-1.63

Pairs =2

Before GFC

Holding \ Formation	1	2	3	4	5
1	7.23	1.03	-1.29	-2.01	0
2	2.62	-1.35	-2.94	-3.16	-0.04
3	0.12	-2.8	-2.82	-2.08	0.19
4	-0.14	-1.75	-1.61	-1.14	1.38
5	-0.06	-1.04	-0.63	-0.51	1.74

After GFC

Holding \ Formation	1	2	3	4	5
1	5.46	2.15	0.68	-2.33	-5.76
2	1.84	-0.76	-1.42	-3.66	-5.09
3	0.68	-1.81	-3.36	-3.87	-4.46
4	-0.22	-2.9	-4.17	-3.61	-4.25
5	-0.93	-3.27	-3.4	-3.1	-3.87

Whole

Holding \ Formation	1	2	3	4	5
1	6.45	2.15	0.21	-1.68	-2.72
2	2.39	-0.55	-1.68	-3.35	-2.55
3	0.46	-1.93	-2.89	-3.06	-2.24
4	0.05	-2.17	-2.8	-2.56	-1.6
5	-0.33	-2.1	-2.1	-2.03	-1.25

Pairs =3

Before GFC

Holding \ Formation	1	2	3	4	5
1	5.07	0.3	-1.03	-2.21	-0.26
2	1.42	-2.57	-2.6	-3.01	-0.26
3	-0.56	-2.84	-2.4	-1.87	0.07
4	-0.21	-2.05	-1.4	-0.97	0.83
5	0.1	-1.2	-0.61	-0.35	1.05

After GFC

Holding \ Formation	1	2	3	4	5
1	4.96	1.35	0.62	-1.31	-2.81
2	1.94	-0.9	-0.97	-3.12	-4.11
3	1.11	-1.24	-3.01	-3.61	-3.9
4	0.01	-2.43	-3.92	-3.58	-3.62
5	-0.97	-2.88	-3.37	-3.13	-3.21

Whole

Holding \ Formation	1	2	3	4	5
1	5.15	1.38	0.31	-1.29	-1.34
2	1.91	-1.16	-1.34	-2.96	-2.19
3	0.42	-1.62	-2.52	-2.76	-2.1
4	0.03	-2.03	-2.59	-2.33	-1.63
5	-0.36	-1.9	-2.07	-1.89	-1.32

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007
Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 3.3: Weekly Portfolio – Annualized Percentage Excess Return

Pairs =1

Before GFC

Holding \ Formation	1	2	3	4	5
1	-0.55	1.68	3.18	1.48	2.67
2	1.51	1.06	2.93	2.25	3.37
3	0.97	2.16	3.84	2.97	3.25
4	2.25	2.84	3.12	2.61	2.29
5	2.15	2.01	2.29	1.4	2.5

After GFC

Holding \ Formation	1	2	3	4	5
1	-10.28	-6.93	-1.02	-3.74	-2.4
2	-5.79	-3.61	-0.44	-4.1	-3.18
3	-4.08	-1.52	-0.55	-3.87	-2.78
4	-3.1	-2.59	-2.68	-4.5	-1.44
5	-4.37	-1.82	-2.06	-3.23	-1.35

Whole Period

Holding \ Formation	1	2	3	4	5
1	-5.73	-3.68	0.85	-1.16	-0.48
2	-2.45	-1.02	1.03	-1.07	-0.41
3	-1.62	0.19	1.41	-0.82	-0.58
4	-0.86	-0.38	-0.29	-1.83	-0.54
5	-1.48	-0.22	-0.5	-1.4	-0.19

Pairs =2

Before GFC

Holding \ Formation	1	2	3	4	5
1	0.9	3.24	2.12	3.98	2.17
2	1.37	1.69	3.6	3.82	2.57
3	0.62	2.15	3.39	3.01	1.91
4	0.67	2.7	2.95	2.6	1.71
5	0.53	2.29	2.03	2.32	1.65

After GFC

Holding \ Formation	1	2	3	4	5
1	-5.09	-5.26	-1.72	-1	-0.98
2	-3.46	-3.17	-0.67	-1.51	-1.35
3	-2.01	-1.44	-0.54	-1.73	-1.35
4	-1.55	-2.04	-1.34	-2.25	-0.49
5	-2.43	-2.23	-1.28	-1.97	-0.47

Whole

Holding \ Formation	1	2	3	4	5
1	-2.67	-1.87	0.07	0.78	0.24
2	-1.37	-0.71	1.38	0.82	0.21
3	-0.69	0.2	1.15	0.18	-0.35
4	-0.72	-0.16	0.24	-0.58	-0.04
5	-1.11	-0.39	-0.2	-0.34	0.05

Pairs =3

Before GFC

Holding \ Formation	1	2	3	4	5
1	1.57	2.18	1.53	2.43	2.15
2	1.9	1.6	2.22	2.92	1.33
3	1.21	1.95	1.76	1.87	0.87
4	1.16	2	1.43	1.87	0.88
5	0.89	1.8	1.01	1.72	0.59

After GFC

Holding \ Formation	1	2	3	4	5
1	-4.6	-4.18	-0.44	0.31	-0.28
2	-3.14	-1.72	-0.54	-0.03	-0.7
3	-1.72	-0.9	-0.28	-0.55	-0.88
4	-0.9	-1.11	-0.93	-0.97	-0.52
5	-1.48	-1.1	-1.05	-0.58	-0.38

Whole

Holding \ Formation	1	2	3	4	5
1	-2.26	-1.55	0.46	0.84	0.37
2	-0.94	-0.03	0.8	1.21	-0.04
3	-0.25	0.38	0.66	0.31	-0.53
4	-0.13	0.06	-0.09	-0.18	-0.4
5	-0.43	0.01	-0.38	0.07	-0.31

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007
Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 3.4: Weekly Portfolio – Annualized Percentage Spot Return

Pairs =1

Before GFC

Holding \ Formation	1	2	3	4	5
1	-1.51	-2.24	-1.95	-2.39	-1.5
2	-0.02	-3	-0.45	-0.7	-1.17
3	-0.99	-2	-0.01	-0.58	-1.16
4	-0.18	-0.6	-0.09	-0.35	-1.71
5	-0.4	-0.96	-0.79	-0.97	-1.53

After GFC

Holding \ Formation	1	2	3	4	5
1	-8.64	-5.4	-1.42	-3.29	-2.04
2	-6.66	-2.98	-0.7	-2.62	-2.15
3	-3.94	-1.34	-0.34	-2.8	-2.15
4	-3.18	-2.02	-2.17	-3.62	-1.02
5	-4.68	-1.76	-1.93	-2.62	-0.9

Whole

Holding \ Formation	1	2	3	4	5
1	-5.53	-4.34	-1.61	-3.13	-1.93
2	-3.77	-2.47	-0.52	-1.74	-1.88
3	-2.54	-1.57	-0.23	-1.92	-2.25
4	-2.09	-1.67	-1.6	-2.78	-1.97
5	-2.86	-1.55	-1.86	-2.14	-1.77

Pairs =2

Before GFC

Holding \ Formation	1	2	3	4	5
1	-1.34	-0.82	-0.38	-1.09	-0.65
2	-0.11	-1.2	0.87	-0.8	-0.39
3	-0.56	-0.81	0.99	-0.97	-1.16
4	-0.65	-0.18	0.67	-1.07	-1.35
5	-0.83	-0.65	-0.22	-1.05	-1.29

After GFC

Holding \ Formation	1	2	3	4	5
1	-5.04	-4.37	-1.22	-1	-0.97
2	-3.82	-2.74	-0.52	-1.65	-1.96
3	-2.4	-1.13	-0.81	-1.45	-1.47
4	-1.68	-1.72	-1.48	-1.99	-0.74
5	-2.43	-1.76	-1.27	-1.63	-0.86

Whole

Holding \ Formation	1	2	3	4	5
1	-3.55	-3.36	-0.84	-1.67	-1.04
2	-2.11	-1.82	0.13	-1.41	-1.29
3	-1.28	-1.06	-0.01	-1.49	-1.7
4	-1.26	-1.31	-0.82	-2.12	-1.57
5	-1.62	-1.38	-1.19	-1.74	-1.45

Pairs =3

Before GFC

Holding \ Formation	1	2	3	4	5
1	0.42	-0.9	-0.92	-0.06	-1.1
2	0.56	-0.5	-0.26	-0.45	-1.1
3	0.13	-0.53	-0.39	-0.96	-1.57
4	-0.03	-0.31	-0.73	-1.04	-1.4
5	-0.33	-0.49	-1.1	-0.9	-1.23

After GFC

Holding \ Formation	1	2	3	4	5
1	-4.52	-4.98	0.24	0.02	-0.39
2	-3.32	-1.78	-0.28	-0.12	-0.77
3	-1.75	-0.65	-0.25	-0.6	-0.55
4	-1.2	-0.94	-0.68	-0.86	-0.16
5	-1.66	-1.05	-0.75	-0.65	-0.14

Whole

Holding \ Formation	1	2	3	4	5
1	-2.59	-3.21	-0.29	-0.37	-0.91
2	-1.62	-0.89	-0.14	-0.39	-1.05
3	-0.73	-0.54	-0.25	-0.99	-1.38
4	-0.8	-0.82	-0.88	-1.45	-1.16
5	-1.08	-0.89	-1.14	-1.18	-0.98

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007
Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 3.5: Monthly Portfolio – Annualized Percentage Excess Return

Pairs =1

Before GFC

Holding \ Formation	1	3	6	9	12
1	1.61	3.78	0.01	4.6	-0.78
3	2.01	2.6	1.69	3.63	0.27
6	2.49	3.34	2.82	2.1	1.93
9	2.77	3.58	2.25	2.06	2.27
12	1.99	2.69	2.87	2.31	2.92

After GFC

Holding \ Formation	1	3	6	9	12
1	0.01	-0.96	-3.58	-4.06	-3.37
3	0.26	-1.72	-4.02	-3.2	-3.47
6	-2.43	-3.45	-4.05	-3.6	-3.3
9	-1.06	-3.8	-2.97	-2.53	-2.51
12	-1.16	-3	-2.56	-1.78	-1.6

Whole Period

Holding \ Formation	1	3	6	9	12
1	0.3	2.26	-1.02	0.02	-2.42
3	1.23	1.16	-0.94	0.17	-1.5
6	0.3	0.29	-0.33	-0.5	-1.62
9	0.95	0.35	-0.1	-0.41	-1.38
12	0.59	0.28	0.08	-0.59	-0.78

Pairs =2

Before GFC

Holding \ Formation	1	3	6	9	12
1	2.68	3.48	4.71	4.78	3.08
3	2.35	3.66	3.88	4.03	3.3
6	2.12	3.05	3.86	3.25	3.13
9	2.4	2.85	3.12	3.08	3.37
12	1.85	2.6	3.55	3.53	3.8

After GFC

Holding \ Formation	1	3	6	9	12
1	1.72	0.71	-4.22	-0.66	-4.36
3	1.92	-1.01	-2.82	-1.31	-3.62
6	-1.27	-2.88	-3.38	-2.48	-2.57
9	-1.21	-2.8	-2.95	-2.39	-1.87
12	-0.86	-2.16	-2.28	-1.6	-0.64

Whole

Holding \ Formation	1	3	6	9	12
1	1.86	2.42	0.56	1.73	-0.63
3	1.94	1.44	0.75	1.21	-0.37
6	0.48	0.27	0.4	0.29	-0.81
9	0.68	0.34	0.06	0.04	-0.62
12	0.76	0.38	0.1	-0.01	0.01

Pairs =3

Before GFC

Holding \ Formation	1	3	6	9	12
1	2.06	3.54	4.4	4.67	2.53
3	1.57	3.64	3.6	4.05	2.27
6	1.58	2.88	3.07	3.03	2.37
9	2.01	2.63	2.67	2.63	2.39
12	1.59	2.25	3	2.84	3.06

After GFC

Holding \ Formation	1	3	6	9	12
1	1.13	2.11	-2.72	-0.63	-3.86
3	1.66	-0.63	-2.24	-0.85	-2.96
6	-1.18	-2.27	-3.01	-2.12	-2.1
9	-1.51	-2.26	-2.75	-2.03	-1.55
12	-1.25	-1.91	-2.11	-1.54	-0.46

Whole

Holding \ Formation	1	3	6	9	12
1	1.22	2.92	0.91	1.58	-0.48
3	1.53	1.43	0.89	1.35	-0.39
6	0.22	0.46	0.18	0.22	-0.51
9	0.23	0.55	-0.04	-0.19	-0.42
12	0.25	0.38	-0.1	-0.26	0.08

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007
Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 3.6: Monthly Portfolio – Annualized Percentage Spot Return

Pairs =1

Before GFC

Holding \ Formation	1	3	6	9	12
1	-1.88	-0.99	-3	-0.64	-1.16
3	-0.76	-0.19	-0.76	-0.21	-1.12
6	-0.27	-0.94	-0.25	-0.57	-2
9	0.05	-0.56	-1.09	-1.1	-1.81
12	-1.07	-1.34	-0.66	-1.34	-1.1

After GFC

Holding \ Formation	1	3	6	9	12
1	0.14	-0.72	-1.79	0.73	-5.55
3	-0.37	-2.5	-2.46	-1.92	-2.86
6	-1.97	-3.31	-3.3	-2.97	-2.93
9	-0.99	-3.36	-2.44	-1.97	-2.3
12	-1.15	-2.42	-1.98	-0.3	-0.4

Whole

Holding \ Formation	1	3	6	9	12
1	-1.05	-0.67	-1.85	-0.62	-2.5
3	-0.4	-1.04	-1.39	-1.51	-2.14
6	-0.95	-1.64	-1.54	-2.22	-3.14
9	-0.29	-1.3	-1.73	-2.04	-2.28
12	-0.86	-1.17	-1.49	-1.48	-1.33

Pairs =2

Before GFC

Holding \ Formation	1	3	6	9	12
1	-1.09	-2.17	-2.34	-1.54	-2.2
3	-0.73	-0.89	-1.81	-0.94	-2.16
6	-0.39	-1.09	-1.38	-1.56	-2.35
9	0.3	-1.05	-1.21	-1.74	-2.56
12	-0.2	-1.13	-1.03	-1.55	-1.91

After GFC

Holding \ Formation	1	3	6	9	12
1	1.72	1.32	-2.51	-0.73	-4.94
3	1.93	-0.81	-1.66	-1.51	-4.11
6	-0.83	-2.33	-3.22	-2.53	-3.21
9	-0.98	-2.7	-2.99	-2.38	-2.14
12	-0.68	-2.13	-2.08	-1.29	-0.95

Whole

Holding \ Formation	1	3	6	9	12
1	-0.03	-0.18	-1.59	-1.14	-1.75
3	0.64	-0.45	-1.1	-1.26	-1.79
6	-0.37	-1.29	-1.88	-2.19	-2.61
9	-0.09	-1.35	-2.03	-2.29	-2.46
12	-0.19	-1.21	-1.82	-1.76	-1.88

Pairs =3

Before GFC

Holding \ Formation	1	3	6	9	12
1	-1.1	-1.26	-1.82	-0.39	-2.9
3	-1.02	0.02	-1.52	-0.62	-1.6
6	-0.45	-0.48	-1.45	-1.13	-1.59
9	0.16	-0.43	-1.24	-1.31	-1.89
12	-0.15	-0.59	-1.09	-1.37	-1.3

After GFC

Holding \ Formation	1	3	6	9	12
1	0.94	1.3	-2.23	0.23	-2.88
3	1.56	-0.98	-1.76	-1.54	-3.21
6	-0.92	-2.53	-2.78	-2.54	-2.3
9	-1.34	-2.61	-2.66	-2.25	-1.64
12	-1.24	-2.2	-1.87	-1.36	-0.5

Whole

Holding \ Formation	1	3	6	9	12
1	-0.51	0.64	-1.54	-0.11	-1.76
3	0.21	-0.09	-1.27	-1.13	-1.62
6	-0.61	-1.11	-1.67	-1.83	-1.99
9	-0.59	-1.02	-1.62	-1.89	-2.04
12	-0.69	-0.96	-1.35	-1.57	-1.42

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007
Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 4.1: Daily Portfolio – Annualized Percentage Excess Return (Majors)

Pairs =1

Before GFC

Holding \ Formation	1	2	3	4	5
1	5.73	1.98	-1.21	-0.4	-1
2	0.64	-1.06	-2.56	-1.75	-1.59
3	-1.01	-1.44	-2.35	-1.4	-1.46
4	-1.07	-1.22	-1.78	-0.65	-1.23
5	-0.57	-0.77	-0.86	-0.39	-1.13

After GFC

Holding \ Formation	1	2	3	4	5
1	3.59	-0.88	0.57	-1.64	0.5
2	1.21	-1.03	-0.86	-1.26	-2
3	-0.83	-0.84	-1	-1.87	-2.16
4	-0.41	-1.16	-1.3	-1.79	-1.47
5	-0.56	-1.6	-1.16	-1.38	-1.01

Whole Period

Holding \ Formation	1	2	3	4	5
1	5.29	1.42	0.53	-0.34	0.09
2	1.41	-0.1	-1.21	-1.19	-1.4
3	-0.71	-0.52	-1.45	-1.44	-1.57
4	-0.54	-0.74	-1.28	-1.09	-1.05
5	-0.32	-0.79	-0.89	-0.67	-0.73

Pairs =2

Before GFC

Holding \ Formation	1	2	3	4	5
1	3.37	1.47	-0.4	0.25	-0.95
2	0.19	-0.81	-1.27	-0.85	-0.74
3	-0.82	-1.09	-1.73	-1.11	-0.87
4	-1.07	-1.18	-1.33	-0.74	-0.64
5	-0.71	-0.64	-0.81	-0.55	-0.79

After GFC

Holding \ Formation	1	2	3	4	5
1	-0.59	0.28	0.77	0.21	-1.51
2	-0.52	-0.13	-0.81	-1.85	-3.41
3	-0.9	-0.48	-1.96	-2.22	-3.61
4	-0.28	-0.61	-2.14	-2.36	-2.82
5	-0.89	-1.49	-1.82	-1.95	-2.4

Whole

Holding \ Formation	1	2	3	4	5
1	1.82	1.69	0.96	0.84	-0.6
2	0.3	0.18	-0.53	-1.07	-1.69
3	-0.63	-0.33	-1.53	-1.47	-1.92
4	-0.49	-0.58	-1.54	-1.37	-1.41
5	-0.63	-0.75	-1.19	-1.01	-1.25

Pairs =3

Before GFC

Holding \ Formation	1	2	3	4	5
1	2.64	0.87	-0.08	-0.09	-0.19
2	0.49	-0.88	-1.24	-0.94	-0.92
3	-0.4	-1.33	-1.68	-1.03	-0.95
4	-0.78	-1.15	-1.39	-0.82	-0.69
5	-0.41	-0.68	-0.73	-0.51	-0.54

After GFC

Holding \ Formation	1	2	3	4	5
1	0.59	-0.31	1.18	0.48	-1.13
2	-0.56	-0.81	-0.43	-1.44	-1.9
3	-0.8	-0.66	-1.55	-2.14	-2.72
4	-0.49	-1.03	-1.76	-2.38	-2.4
5	-1.02	-1.47	-1.64	-1.95	-2.09

Whole

Holding \ Formation	1	2	3	4	5
1	1.95	0.98	1.12	0.74	-0.52
2	0.3	-0.39	-0.4	-0.9	-1.26
3	-0.5	-0.68	-1.37	-1.39	-1.74
4	-0.53	-0.89	-1.38	-1.45	-1.46
5	-0.62	-0.92	-1.11	-1.13	-1.22

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007

Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 4.2: Daily Portfolio – Annualized Percentage Excess Return (Minors & Exotics)

Pairs =1

Before GFC

Holding \ Formation	1	2	3	4	5
1	4.51	3.18	-0.59	-4.18	-1.78
2	1.93	0.49	-1.95	-2.97	-1.88
3	-0.77	-0.33	-1.94	-2.2	-0.47
4	-0.86	0.29	-1.67	-0.72	0.07
5	-0.23	0.81	-1.1	0.01	1.72

After GFC

Holding \ Formation	1	2	3	4	5
1	4.74	5.72	3.96	-1.77	-2.3
2	1.16	0.76	0.35	-2.99	-1.85
3	0.79	-0.55	-1.58	-2.97	-2.1
4	-0.65	-2.12	-2.76	-2.61	-1.49
5	-1.77	-1.91	-2.54	-1.43	-1.12

Whole Period

Holding \ Formation	1	2	3	4	5
1	4.24	4.49	1.7	-2.8	-1.57
2	1.15	0.6	-0.88	-3.23	-1.8
3	-0.25	-0.57	-2.1	-2.95	-1.7
4	-0.81	-1.29	-2.6	-2.16	-1.24
5	-1.28	-1.02	-2.39	-1.3	-0.33

Pairs =2

Before GFC

Holding \ Formation	1	2	3	4	5
1	2.05	-0.52	-1.57	0	0.11
2	0.69	-2.1	-2.86	-1.3	-0.27
3	-1.82	-2.29	-2.17	-0.91	0.15
4	-1.15	-1.35	-1.07	0.35	1.3
5	-0.87	-0.76	-0.44	0.86	2.04

After GFC

Holding \ Formation	1	2	3	4	5
1	3.9	3.6	2.03	0.71	-2.48
2	0.87	0.37	-0.49	-1.78	-2.69
3	0.17	-0.75	-2.73	-2.16	-1.94
4	-0.83	-2.39	-3.13	-2.36	-1.87
5	-1.82	-2.27	-2.53	-1.98	-1.5

Whole

Holding \ Formation	1	2	3	4	5
1	2.72	1.76	0.48	0.56	-1.29
2	0.71	-0.7	-1.28	-1.59	-1.67
3	-0.85	-1.38	-2.38	-1.81	-1.27
4	-0.96	-1.88	-2.16	-1.38	-0.76
5	-1.45	-1.62	-1.74	-1.05	-0.26

Pairs =3

Before GFC

Holding \ Formation	1	2	3	4	5
1	1.58	-0.57	-1.59	0.04	0.24
2	0.47	-2.35	-2.09	-0.77	0.15
3	-1.16	-2.45	-1.86	-0.59	0.14
4	-0.23	-1.29	-1.12	0.08	0.9
5	-0.03	-0.66	-0.62	0.41	1.24

After GFC

Holding \ Formation	1	2	3	4	5
1	4.34	4.43	4.29	0.9	-1.26
2	1.77	1.37	0.45	-2.1	-2.08
3	0.46	0.14	-1.63	-2.94	-1.78
4	-0.43	-1.65	-2.21	-2.92	-1.69
5	-0.9	-2.17	-1.82	-2.35	-1.29

Whole

Holding \ Formation	1	2	3	4	5
1	2.98	2.18	1.61	0.63	-0.56
2	1.17	-0.26	-0.49	-1.37	-1.02
3	-0.33	-0.99	-1.6	-1.84	-1.04
4	-0.31	-1.44	-1.63	-1.57	-0.72
5	-0.53	-1.46	-1.3	-1.23	-0.39

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007

Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 4.3: Daily Portfolio – Annualized Percentage Spot Return (Majors)

Pairs =1

Before GFC

Holding \ Formation	1	2	3	4	5
1	6.45	2.3	-0.52	-0.5	-0.8
2	1.84	-0.74	-2.26	-1.56	-1.28
3	-0.19	-1.16	-2.08	-1	-1.17
4	-0.28	-0.96	-1.7	-0.41	-1
5	0.07	-0.58	-0.78	-0.3	-0.75

After GFC

Holding \ Formation	1	2	3	4	5
1	5.34	-0.93	-0.14	-1.53	-0.35
2	2.93	-1.37	-1.23	-0.81	-2.46
3	0.43	-1.04	-1.24	-1.21	-2.57
4	0.81	-1.32	-1.38	-1.45	-1.68
5	0.38	-1.77	-1.36	-1.05	-1.19

Whole

Holding \ Formation	1	2	3	4	5
1	6.55	1.75	0.63	-0.2	-0.09
2	2.76	-0.09	-1.09	-0.86	-1.41
3	0.34	-0.55	-1.33	-0.91	-1.61
4	0.46	-0.74	-1.18	-0.77	-1.02
5	0.46	-0.82	-0.87	-0.46	-0.64

Pairs =2

Before GFC

Holding \ Formation	1	2	3	4	5
1	4.88	1.46	-0.43	0.64	-0.82
2	1.54	-0.7	-1.11	-0.8	-0.79
3	0.25	-0.99	-1.82	-0.87	-0.88
4	-0.18	-1.14	-1.28	-0.53	-0.46
5	-0.03	-0.54	-0.6	-0.46	-0.53

After GFC

Holding \ Formation	1	2	3	4	5
1	1.28	0.1	0.28	-0.44	-1.9
2	1.15	-0.59	-1.07	-2	-3.72
3	0.44	-0.86	-2.01	-2.36	-3.92
4	0.73	-0.97	-2.16	-2.5	-3.14
5	-0.03	-1.8	-1.81	-2.03	-2.68

Whole

Holding \ Formation	1	2	3	4	5
1	3.52	1.6	0.75	0.73	-0.87
2	1.77	-0.05	-0.54	-1.13	-1.9
3	0.56	-0.52	-1.54	-1.41	-2.13
4	0.43	-0.74	-1.46	-1.32	-1.52
5	0.15	-0.86	-1.05	-0.98	-1.28

Pairs =3

Before GFC

Holding \ Formation	1	2	3	4	5
1	3.66	1.23	0.4	0.36	0.15
2	1.22	-0.58	-0.93	-0.75	-0.58
3	0.28	-1.14	-1.46	-0.84	-0.52
4	-0.12	-0.95	-1.2	-0.63	-0.41
5	0.11	-0.5	-0.64	-0.31	-0.28

After GFC

Holding \ Formation	1	2	3	4	5
1	1.71	-0.61	0.7	0.23	-1.01
2	0.39	-0.83	-0.7	-1.48	-1.79
3	-0.06	-0.78	-1.7	-2.28	-2.71
4	0.16	-1.1	-1.77	-2.47	-2.44
5	-0.55	-1.5	-1.7	-2.12	-2.11

Whole

Holding \ Formation	1	2	3	4	5
1	3.03	0.98	1.09	0.86	-0.3
2	1.15	-0.29	-0.36	-0.82	-1.02
3	0.23	-0.68	-1.28	-1.36	-1.5
4	0.13	-0.86	-1.24	-1.39	-1.34
5	-0.1	-0.86	-1.04	-1.12	-1.1

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007

Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 4.4: Daily Portfolio – Annualized Percentage Spot Return (Minors & Exotics)

Pairs =1

Before GFC

Holding \ Formation	1	2	3	4	5
1	6.39	1.93	-0.61	-4.7	-1.34
2	3.64	-1.06	-1.99	-4.37	-0.74
3	0.5	-1.4	-1.9	-3.13	0.86
4	0.04	-1.16	-1.07	-1.58	1.48
5	0.34	-0.36	-0.57	-0.65	2.85

After GFC

Holding \ Formation	1	2	3	4	5
1	6.21	5.96	3.23	-1.4	-3.93
2	1.93	0.91	-0.12	-3.11	-3.19
3	1.7	-0.79	-2.32	-3.26	-3.29
4	0.32	-2.16	-3.52	-2.82	-3.01
5	-0.92	-2.18	-3.42	-1.76	-2.37

Whole

Holding \ Formation	1	2	3	4	5
1	5.94	4.05	1.37	-2.92	-2.35
2	2.4	-0.03	-1.05	-4	-2.13
3	0.88	-1.13	-2.42	-3.59	-1.76
4	0.16	-1.9	-2.69	-2.71	-1.4
5	-0.48	-1.61	-2.56	-1.84	-0.49

Pairs =2

Before GFC

Holding \ Formation	1	2	3	4	5
1	3.42	-1.09	-2.07	-1.27	0.75
2	1.32	-2.63	-3.16	-2.15	0.78
3	-0.98	-2.84	-2.47	-1.38	0.66
4	-0.35	-1.84	-1.25	-0.23	1.69
5	-0.22	-0.96	-0.6	0.29	2.08

After GFC

Holding \ Formation	1	2	3	4	5
1	4.49	4.63	1.76	0.19	-2.18
2	1.63	0.83	-0.53	-2.1	-2.91
3	0.79	-0.31	-2.7	-2.46	-2.55
4	-0.17	-1.85	-3.33	-2.91	-2.38
5	-1.32	-2.06	-2.89	-2.6	-1.92

Whole

Holding \ Formation	1	2	3	4	5
1	3.67	2.12	0.15	-0.17	-0.88
2	1.42	-0.59	-1.44	-1.97	-1.34
3	-0.11	-1.31	-2.54	-2.04	-1.36
4	-0.27	-1.78	-2.35	-1.83	-0.88
5	-0.88	-1.56	-2	-1.54	-0.5

Pairs =3

Before GFC

Holding \ Formation	1	2	3	4	5
1	3.33	-0.46	-2.3	0.02	-0.3
2	1.42	-1.95	-2.15	-0.56	-0.15
3	-0.5	-2.07	-1.9	-0.39	0.01
4	0.29	-0.91	-1.12	0.36	0.74
5	0.42	-0.38	-0.53	0.69	1.05

After GFC

Holding \ Formation	1	2	3	4	5
1	4.72	4.31	3.68	0.86	-1.4
2	2.09	1.04	0.36	-2.27	-2.69
3	0.67	0.03	-1.53	-3.1	-2.34
4	-0.23	-1.64	-2.3	-3.11	-2.32
5	-0.87	-2.23	-1.89	-2.68	-1.96

Whole

Holding \ Formation	1	2	3	4	5
1	4.06	2.21	1.03	0.65	-0.8
2	1.87	-0.21	-0.51	-1.29	-1.41
3	0.15	-0.87	-1.52	-1.77	-1.37
4	0.07	-1.26	-1.63	-1.51	-1.1
5	-0.27	-1.36	-1.27	-1.25	-0.83

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007

Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 4.5: Weekly Portfolio Annualized Percentage Excess Return (Majors)

Pairs =1

Before GFC

Holding \ Formation	1	2	3	4	5
1	-1.33	-2.36	-1.78	-0.96	-3.16
2	-1.73	-1.99	-2.16	-2.71	-3.6
3	-2.13	-2.26	-2.85	-2.56	-3.02
4	-2.08	-2.32	-2.7	-1.71	-2.3
5	-1.78	-1.71	-1.88	-0.88	-1.43

After GFC

Holding \ Formation	1	2	3	4	5
1	-4.91	-0.42	2.14	1.86	1.14
2	-1.75	-1.04	1.97	1.16	-0.32
3	-1.84	-0.47	1.12	-0.36	-0.3
4	-1.48	-0.65	-0.06	-1.93	0.28
5	-3.29	-1.48	-0.16	-1.05	1.02

Whole Period

Holding \ Formation	1	2	3	4	5
1	-2.77	-1.58	0.72	0.28	-1.16
2	-1.59	-1.07	0.1	-0.94	-2.28
3	-1.62	-1.13	-0.92	-1.84	-2.27
4	-2	-1.7	-1.72	-2.56	-1.78
5	-2.73	-1.76	-1.52	-1.7	-0.8

Pairs =2

Before GFC

Holding \ Formation	1	2	3	4	5
1	-0.86	-0.89	-0.72	-1.82	-3.79
2	-0.56	-0.98	-1.28	-2.1	-3.53
3	-0.62	-1.47	-2.15	-2.06	-2.86
4	-0.74	-1.88	-1.94	-1.49	-1.85
5	-0.84	-1.47	-1.36	-0.86	-1.51

After GFC

Holding \ Formation	1	2	3	4	5
1	-4.94	0.92	-0.75	0.92	0.62
2	-2.37	-0.34	0.45	0.47	-1.2
3	-1.69	-0.53	-0.26	-0.58	-1
4	-1.22	-0.95	-0.11	-0.64	-0.69
5	-2.16	-1.2	-0.27	-0.21	-0.24

Whole

Holding \ Formation	1	2	3	4	5
1	-2.65	-0.13	-0.53	-0.74	-1.73
2	-1.56	-0.54	-0.56	-1.11	-2.58
3	-0.96	-1.11	-1.26	-1.8	-2.53
4	-1.29	-1.73	-1.46	-1.8	-2.02
5	-1.75	-1.7	-1.3	-1.19	-1.48

Pairs =3

Before GFC

Holding \ Formation	1	2	3	4	5
1	-0.77	-1.83	-0.72	-1.59	-1.61
2	-0.39	-1.15	-0.9	-1.52	-1.86
3	-0.14	-1.14	-1.17	-1.4	-1.54
4	-0.58	-1.35	-1.43	-1.26	-1.02
5	-0.89	-1.07	-0.89	-0.85	-0.81

After GFC

Holding \ Formation	1	2	3	4	5
1	-2.63	0.33	0	0.3	-1.77
2	-1.3	-0.41	0.44	0.55	-1.48
3	-1.08	-0.62	-0.16	-0.17	-1.11
4	-0.65	-1.09	-0.26	-0.11	-0.81
5	-1.18	-1.02	-0.25	-0.22	-0.37

Whole

Holding \ Formation	1	2	3	4	5
1	-1.76	-0.99	-0.12	-1	-1.87
2	-1.15	-0.83	-0.3	-0.62	-1.92
3	-0.67	-1.01	-0.7	-0.96	-1.75
4	-0.94	-1.47	-1.13	-1.1	-1.4
5	-1.26	-1.32	-0.92	-0.88	-0.98

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007

Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 4.6: Weekly Portfolio Annualized Percentage Excess Return (Minors & Exotics)

Pairs =1

Before GFC

Holding \ Formation	1	2	3	4	5
1	0.71	7.15	5.37	3.72	3.64
2	2.9	4.79	6.12	4.66	4.41
3	2.18	5.37	6.55	3.98	3.73
4	3.38	5.76	4.87	3.19	2.62
5	2.88	4.39	3.69	2.19	2.79

After GFC

Holding \ Formation	1	2	3	4	5
1	-5.31	-1.96	0.09	-0.56	-2.74
2	-4.23	0.33	0.09	-2.16	-2.02
3	-1.98	0.8	0.35	-1.57	-2.23
4	-1.8	-0.76	-1.15	-2.83	-2.25
5	-2.39	-0.63	-1.47	-2.53	-2.07

Whole Period

Holding \ Formation	1	2	3	4	5
1	-2.88	1	2.37	1.3	0.04
2	-0.68	2.2	3.08	1.11	1.15
3	0.24	2.63	3.32	1.27	0.56
4	0.8	1.89	1.62	-0.1	0.11
5	0.45	1.48	0.78	-0.15	0.4

Pairs =2

Before GFC

Holding \ Formation	1	2	3	4	5
1	2.19	4.14	5.27	5.85	5.83
2	2.64	4.01	6.03	5.93	4.68
3	2.77	4.38	5.35	5.07	3.68
4	2.6	4.38	4.78	4.54	3.27
5	2.09	3.76	3.73	3.69	2.56

After GFC

Holding \ Formation	1	2	3	4	5
1	-3.15	-3.83	0.17	0.39	-0.54
2	-3.02	-1.17	-0.32	-0.47	-0.56
3	-1.12	-0.62	-0.54	-1.02	-0.8
4	-0.77	-0.81	-1.56	-1.68	-0.6
5	-0.65	-1.02	-1.88	-1.43	-0.81

Whole

Holding \ Formation	1	2	3	4	5
1	-1.39	-0.49	2.29	2.28	2.06
2	-0.51	1.3	2.45	2.37	1.82
3	0.61	1.64	2.12	1.77	1.18
4	0.66	1.45	1.24	0.95	1.11
5	0.62	1.12	0.55	0.83	0.8

Pairs =3

Before GFC

Holding \ Formation	1	2	3	4	5
1	1.94	3.56	4.1	3.99	5.47
2	2.67	3.49	4	4.6	4.18
3	2.25	3.59	3.63	3.6	2.98
4	2.42	3.32	3.28	2.99	2.7
5	2.05	2.91	2.49	2.33	1.73

After GFC

Holding \ Formation	1	2	3	4	5
1	-3.19	-4.52	0.36	1.24	-0.32
2	-3.39	-0.65	0.11	0.77	-0.24
3	-1.46	-0.06	0.13	0.74	-0.45
4	-1.21	-0.24	-0.26	0.03	-0.48
5	-1.15	-0.67	-0.92	-0.39	-0.8

Whole

Holding \ Formation	1	2	3	4	5
1	-1.28	-1.08	1.8	2.06	1.99
2	-0.6	1.27	1.72	2.33	1.6
3	0.3	1.49	1.59	1.82	0.95
4	0.43	1.15	1.15	1.06	0.76
5	0.36	0.8	0.45	0.65	0.31

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007

Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 4.7: Weekly Portfolio Annualized Percentage Spot Return (Majors)

Pairs =1

Before GFC

Holding \ Formation	1	2	3	4	5
1	-1.47	-3.68	-4.67	-2.39	-4.81
2	-1.93	-2.56	-3.9	-3.04	-5.14
3	-2.23	-2.77	-4.06	-3.14	-4.71
4	-2.23	-3.12	-3.68	-2.22	-3.77
5	-2.08	-2.27	-2.63	-1.46	-2.6

After GFC

Holding \ Formation	1	2	3	4	5
1	-4.52	0.39	3.86	2.67	1.19
2	-2.08	-0.67	2.5	1.86	-0.35
3	-1.8	-0.15	1.68	0.18	-0.61
4	-1.36	-0.47	0.26	-1.3	-0.15
5	-3.04	-1.39	0.12	-0.57	0.59

Whole

Holding \ Formation	1	2	3	4	5
1	-2.68	-1.74	0.07	-0.19	-1.57
2	-1.87	-1.2	-0.63	-0.89	-2.8
3	-1.67	-1.27	-1.26	-1.88	-3.07
4	-2.04	-2.06	-2.08	-2.57	-2.64
5	-2.78	-2.05	-1.77	-1.78	-1.6

Pairs =2

Before GFC

Holding \ Formation	1	2	3	4	5
1	-1.19	-1.93	-2	-3.37	-3.99
2	-0.9	-2.05	-2.15	-3.39	-4.11
3	-0.89	-2.23	-2.92	-3.27	-4
4	-1.15	-2.78	-2.79	-2.96	-2.97
5	-1.29	-2.32	-2.21	-2.18	-2.51

After GFC

Holding \ Formation	1	2	3	4	5
1	-5.08	1.22	0.49	1.37	0.38
2	-2.53	0.02	0.9	0.5	-1.12
3	-2.03	-0.08	0.03	-0.53	-1.07
4	-1.53	-0.61	0.19	-0.59	-0.74
5	-2.39	-1.03	-0.1	-0.21	-0.31

Whole

Holding \ Formation	1	2	3	4	5
1	-2.93	-0.51	-0.38	-1.24	-1.79
2	-1.84	-0.86	-0.73	-1.6	-2.73
3	-1.29	-1.16	-1.5	-2.24	-3.04
4	-1.63	-1.9	-1.75	-2.4	-2.49
5	-2.06	-1.93	-1.67	-1.78	-1.9

Pairs =3

Before GFC

Holding \ Formation	1	2	3	4	5
1	-0.83	-2.17	-1.91	-2.17	-3.07
2	-0.74	-1.89	-1.94	-2.55	-2.81
3	-0.78	-1.67	-2.15	-2.45	-2.38
4	-1.11	-1.83	-2.19	-2.26	-1.65
5	-1.4	-1.68	-1.61	-1.77	-1.41

After GFC

Holding \ Formation	1	2	3	4	5
1	-2.89	0.63	0.24	0.35	-1.95
2	-1.41	-0.32	0.44	0.08	-1.39
3	-1.09	-0.42	-0.29	-0.75	-1.34
4	-0.7	-1.09	-0.45	-0.53	-0.78
5	-1.32	-0.98	-0.56	-0.54	-0.51

Whole

Holding \ Formation	1	2	3	4	5
1	-1.98	-1	-0.45	-0.9	-2.76
2	-1.37	-1.13	-0.71	-1.23	-2.42
3	-0.96	-1.2	-1.19	-1.67	-2.32
4	-1.23	-1.73	-1.57	-1.73	-1.75
5	-1.58	-1.62	-1.43	-1.44	-1.37

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007

Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 4.8: Weekly Portfolio Annualized Percentage Spot Return (Minors & Exotics)

Pairs =1

Before GFC

Holding \ Formation	1	2	3	4	5
1	-1.27	0.3	2.32	0.34	-1.47
2	0.77	-0.19	3.38	1.82	0.28
3	-0.42	0.36	2.72	0.93	-0.98
4	0.51	1.27	1.61	0.24	-1.17
5	-0.12	0.44	0.61	-0.47	-1.01

After GFC

Holding \ Formation	1	2	3	4	5
1	-5.25	-2.26	0.74	-2.79	-3.36
2	-4.64	0.06	-0.17	-1.72	-2.28
3	-2.2	0.63	-0.02	-1.61	-1.83
4	-2.01	-0.79	-0.93	-2.94	-2.35
5	-2.76	-0.23	-1.02	-2.81	-2.04

Whole

Holding \ Formation	1	2	3	4	5
1	-3.99	-2.2	0.97	-1.62	-2.2
2	-2.13	-0.27	1.56	-0.05	-0.57
3	-1.19	0.32	1.25	-0.29	-1.19
4	-0.7	-0.09	0.02	-1.69	-1.46
5	-1.23	-0.04	-0.51	-1.69	-1.27

Pairs =2

Before GFC

Holding \ Formation	1	2	3	4	5
1	0.38	1.59	2.15	2.08	2.93
2	0.67	1.31	2.83	2.3	2.1
3	0.65	1.25	1.94	1.74	1.08
4	0.72	1.68	1.27	1.2	0.38
5	0.09	0.95	0.3	0.48	-0.16

After GFC

Holding \ Formation	1	2	3	4	5
1	-3.5	-2.88	0.54	1.26	-0.23
2	-3.49	-0.93	-0.34	-0.19	-0.85
3	-1.38	-0.49	-0.5	-0.43	-0.84
4	-0.98	-0.86	-1.21	-0.97	-0.72
5	-0.61	-0.99	-1.63	-0.8	-1.02

Whole

Holding \ Formation	1	2	3	4	5
1	-2.44	-1.23	0.89	1.15	0.96
2	-1.66	0.17	1.04	0.9	0.57
3	-0.45	0.19	0.66	0.56	-0.03
4	-0.29	0.12	-0.15	-0.23	-0.31
5	-0.28	-0.17	-0.81	-0.34	-0.59

Pairs =3

Before GFC

Holding \ Formation	1	2	3	4	5
1	0.69	1.32	1.78	1.69	1.83
2	1.13	1.14	2.32	2.04	1.37
3	0.92	1.22	1.73	1.33	0.29
4	1.04	1.36	0.93	0.69	-0.11
5	0.9	0.98	0.27	0.2	-0.81

After GFC

Holding \ Formation	1	2	3	4	5
1	-3.49	-4.85	0.82	1.21	-0.01
2	-3.35	-0.88	0.29	0.45	-0.2
3	-1.01	-0.15	0.28	0.51	-0.39
4	-1	-0.33	-0.1	-0.08	-0.38
5	-0.98	-0.74	-0.89	-0.26	-0.7

Whole

Holding \ Formation	1	2	3	4	5
1	-1.96	-2.39	0.87	0.78	0.51
2	-1.31	0.02	1.04	0.94	0.44
3	-0.08	0.34	0.8	0.64	-0.23
4	-0.12	0.23	0.15	-0.1	-0.43
5	-0.1	-0.06	-0.54	-0.23	-0.77

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007

Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 4.9: Monthly Portfolio Annualized Percentage Excess Return (Majors)

Pairs =1

Before GFC

Holding \ Formation	1	3	6	9	12
1	0	0.53	0.44	1.02	1.64
3	-0.72	4.69	2.55	3.18	0.92
6	1.63	3.09	1.6	2.11	1.24
9	0.78	1.42	1	1.46	1.43
12	1.07	0.91	0.64	1.16	1.24

After GFC

Holding \ Formation	1	3	6	9	12
1	0	-0.99	-0.92	-1.53	-1.07
3	2.35	1.83	-3.88	-1.96	-2.26
6	2.24	1.97	-3.71	-0.94	-0.67
9	-0.88	-1.57	-3.02	-1.97	-0.72
12	-1.38	-1.68	-1.87	-1.74	-0.42

Whole Period

Holding \ Formation	1	3	6	9	12
1	0	-0.19	0.22	0	0.18
3	0.26	2.81	-1.01	-0.08	0.48
6	1.7	2.52	-1.23	0.09	0.98
9	-0.13	-0.21	-1.22	-0.08	0.55
12	-0.25	-0.18	-0.25	0.3	0.61

Pairs =2

Before GFC

Holding \ Formation	1	3	6	9	12
1	2.5	0.33	0.86	1.5	1.56
3	-0.83	4.03	3.04	2.6	2.01
6	1.47	3.46	2.42	1.7	1.78
9	1.21	1.77	1.52	1.13	2
12	0.89	0.94	1.24	1.34	2.12

After GFC

Holding \ Formation	1	3	6	9	12
1	0.76	-0.16	0.12	-0.42	-0.69
3	2.83	2.19	-1.29	0.16	-2.3
6	1.54	0.42	-0.49	0.32	-1.13
9	-0.59	-0.83	-0.42	-0.56	-0.88
12	-0.43	-0.27	-0.5	-0.9	-0.75

Whole

Holding \ Formation	1	3	6	9	12
1	0.54	0.09	0.59	0.8	0.08
3	0.67	2.38	0.57	0.72	0.65
6	1.2	1.86	0.82	0.53	0.82
9	0.17	0.46	0.45	0.22	0.45
12	0.19	0.48	0.72	0.18	0.09

Pairs =3

Before GFC

Holding \ Formation	1	3	6	9	12
1	2.53	0.36	0.73	1	1.78
3	-0.54	3.46	2.65	2.17	0.93
6	1.21	2.76	1.97	1.58	1.28
9	0.92	1.34	0.93	1.03	1.04
12	0.74	0.68	0.47	1.37	1.4

After GFC

Holding \ Formation	1	3	6	9	12
1	0.41	0.02	0.32	-0.26	-0.72
3	1.6	1.93	-1.85	0.81	-2.16
6	0.99	0.63	-0.95	0.85	-1.01
9	-0.65	-0.38	-0.21	-0.06	-0.95
12	-0.13	0.08	-0.13	-0.52	-0.96

Whole

Holding \ Formation	1	3	6	9	12
1	0.39	0.1	0.67	0.54	0.18
3	0.31	2.14	-0.08	1.43	-0.06
6	0.74	1.69	0.42	1.26	0.38
9	-0.09	0.48	0.3	0.65	-0.07
12	0.15	0.58	0.48	0.45	-0.18

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007

Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 4.10: Monthly Portfolio Annualized Percentage Excess Return (Minors & Exotics)

Pairs =1

Before GFC

Holding \ Formation	1	3	6	9	12
1	2.94	2.36	2.04	3.68	-0.4
3	1.86	3.3	2.39	3.31	-0.3
6	2.39	4.73	3.14	1.76	1.35
9	2.86	4.8	2.42	1.11	0.9
12	2.32	3.62	2.49	1.18	1.3

After GFC

Holding \ Formation	1	3	6	9	12
1	-2.11	-0.8	-2.7	-0.17	-2.7
3	0.85	-1.59	-2.22	-2.7	-4.98
6	-0.11	-2.56	-3.26	-4.29	-3.55
9	-0.12	-3.16	-3.53	-3.54	-2.21
12	-0.86	-2.77	-2.9	-2.3	-1.14

Whole Period

Holding \ Formation	1	3	6	9	12
1	0.07	2.04	0.29	1.59	-2.4
3	1.53	1.6	0.34	0.64	-3.15
6	1.26	1.59	0.18	-0.77	-2.09
9	1.45	1.33	-0.3	-1.12	-1.69
12	1.01	0.77	-0.18	-1.07	-1.15

Pairs =2

Before GFC

Holding \ Formation	1	3	6	9	12
1	2.85	2.61	6.45	5.16	2.56
3	1.95	3.44	5.17	4.25	2.2
6	2.22	3.11	4.47	3.41	1.74
9	2.53	2.82	3.85	2.95	1.41
12	1.95	2.59	4.26	2.66	2.21

After GFC

Holding \ Formation	1	3	6	9	12
1	0.64	0.92	-2.53	-2.25	-3.53
3	0.81	-1.66	-2.18	-2.77	-5.02
6	-1.09	-2.87	-3.56	-3.77	-3.8
9	-1.02	-3.17	-3.62	-3.27	-2.8
12	-1.07	-2.87	-2.88	-2.53	-1.66

Whole

Holding \ Formation	1	3	6	9	12
1	1.48	2.72	2.32	1.46	-0.31
3	1.48	1.1	1.7	0.59	-1.34
6	0.76	0.45	0.69	-0.54	-1.65
9	0.81	0.15	0.02	-0.74	-1.46
12	0.58	-0.12	0.13	-0.68	-0.69

Pairs =3

Before GFC

Holding \ Formation	1	3	6	9	12
1	2.14	2.14	4.62	3.23	2.34
3	1.51	2.46	3.75	2.94	2.44
6	1.38	2.16	2.68	2.16	1.95
9	1.62	2.46	2.52	2.21	1.63
12	1.47	2.41	2.8	2.21	2.01

After GFC

Holding \ Formation	1	3	6	9	12
1	-0.08	-0.42	-3.45	-1.31	-4.03
3	-0.15	-1.31	-2.56	-3.16	-4.42
6	-1.22	-2.29	-2.7	-3.69	-3.52
9	-1.57	-2.72	-2.93	-3.08	-2.76
12	-1.68	-2.48	-2.37	-2.29	-1.79

Whole

Holding \ Formation	1	3	6	9	12
1	0.51	1.55	1.1	0.95	-0.78
3	0.57	0.85	0.91	-0.31	-1.12
6	0.09	0.46	0.28	-0.95	-1.16
9	0.02	0.22	-0.23	-0.85	-0.95
12	-0.01	-0.07	-0.13	-0.57	-0.49

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007

Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 4.11: Monthly Portfolio Annualized Percentage Spot Return (Majors)

Pairs =1

Before GFC

Holding \ Formation	1	3	6	9	12
1	0	-0.65	-0.79	-0.81	-1.72
3	-1.5	2.78	0.56	-1.8	-4.24
6	1.03	2.67	-0.04	-1.62	-3.77
9	0.01	0.59	-0.99	-2.56	-2.4
12	-0.04	-0.49	-1.24	-1.9	-2.07

After GFC

Holding \ Formation	1	3	6	9	12
1	0	-0.88	-1.25	-1.95	-2.07
3	2.31	2.77	-2.85	-3.12	-2.18
6	1.98	1.84	-3.17	-2.38	-2.11
9	-0.42	-1.5	-2.82	-2.4	-2.86
12	-1.09	-1.51	-2.13	-2.51	-2.65

Whole

Holding \ Formation	1	3	6	9	12
1	0	-0.65	-0.61	-0.65	-1.5
3	-0.08	2.77	-1.83	-2.63	-2.05
6	1.25	2.29	-1.84	-2.27	-1.51
9	-0.24	-0.57	-2.03	-2.19	-1.91
12	-0.6	-0.73	-1.1	-1.58	-1.9

Pairs =2

Before GFC

Holding \ Formation	1	3	6	9	12
1	-1.13	-0.48	-0.5	-0.98	-0.85
3	-2.01	0.39	0.54	0.3	-1.3
6	0.32	1.54	-0.15	-0.41	-0.96
9	0.15	0.22	-1.4	-1.11	-0.87
12	0.05	-0.4	-1.5	-0.96	-0.46

After GFC

Holding \ Formation	1	3	6	9	12
1	-1.25	-0.35	-0.41	-1.18	-1.44
3	1.91	2.26	-1.86	0.29	-1.99
6	1.49	-0.06	-1.25	-0.45	-2.71
9	-0.57	-1.11	-1.16	-1.21	-2.01
12	-0.67	-0.68	-1.21	-1.6	-2.12

Whole

Holding \ Formation	1	3	6	9	12
1	-1.63	-0.42	-0.15	-0.53	-0.73
3	-0.35	1.22	-0.73	0.41	-0.67
6	0.66	0.83	-0.59	-0.06	-0.76
9	-0.28	-0.45	-1.03	-0.39	-0.63
12	-0.37	-0.28	-0.7	-0.41	-0.97

Pairs =3

Before GFC

Holding \ Formation	1	3	6	9	12
1	-0.08	-0.08	-0.4	-0.67	-0.65
3	-1.14	0.63	1.2	0.07	-1.63
6	0.33	1.05	0.48	-0.41	-1.34
9	0.21	0.13	-0.5	-0.98	-1.23
12	0.13	-0.23	-1.02	-0.78	-0.97

After GFC

Holding \ Formation	1	3	6	9	12
1	-0.83	-0.18	0.01	-0.61	-1.31
3	1.24	1.62	-1.62	0.15	-3.07
6	0.55	0.9	-0.86	-0.11	-2.45
9	-1.07	-0.27	-0.46	-0.83	-1.85
12	-0.36	-0.21	-0.57	-1.14	-1.82

Whole

Holding \ Formation	1	3	6	9	12
1	-0.88	-0.21	0	-0.17	-0.64
3	-0.08	0.68	-0.46	0.35	-1.18
6	0.16	1.05	-0.06	0.19	-0.57
9	-0.63	-0.01	-0.24	-0.15	-0.59
12	-0.23	-0.02	-0.15	-0.22	-0.96

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007

Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 4.12: Monthly Portfolio Annualized Percentage Spot Return (Minors & Exotics)

Pairs =1

Before GFC

Holding \ Formation	1	3	6	9	12
1	-0.97	-0.09	-0.92	-0.43	-2.3
3	-2.42	0.6	0.18	-0.18	-1.52
6	-1.66	0.18	-0.25	-0.88	-1.51
9	-0.38	0.27	-1.08	-1.49	-1.94
12	-0.95	-0.59	-0.69	-1.58	-1.13

After GFC

Holding \ Formation	1	3	6	9	12
1	-2.49	-0.48	-2.8	0.92	-3.37
3	0.71	-2.8	-1.57	-3.55	-3.12
6	0.01	-3.11	-3.1	-4.74	-2.41
9	-0.17	-3.5	-3.42	-3.87	-1.61
12	-0.77	-2.99	-2.28	-1.81	-0.83

Whole

Holding \ Formation	1	3	6	9	12
1	-2.03	0.72	-0.73	0.59	-1.65
3	-0.41	-0.48	0.04	-1.67	-1.86
6	-0.28	-0.6	-1.22	-2.75	-2.27
9	0.23	-0.83	-1.93	-2.53	-1.73
12	-0.35	-1.25	-1.28	-1.68	-1.16

Pairs =2

Before GFC

Holding \ Formation	1	3	6	9	12
1	-0.5	-3.85	-2.31	-0.79	-4.18
3	-1.24	-1.03	-0.95	-1.08	-2.53
6	-0.74	-0.93	-0.8	-1.41	-2.05
9	0.21	-0.94	-0.6	-1.61	-2.29
12	-0.23	-1.1	-0.8	-1.74	-1.76

After GFC

Holding \ Formation	1	3	6	9	12
1	0.3	0.26	-2.98	-1.54	-4.13
3	0.48	-1.89	-1.38	-2.82	-4.51
6	-0.83	-2.61	-2.86	-3.77	-2.79
9	-0.95	-3.34	-3.1	-2.98	-1.61
12	-1.17	-3.04	-2.36	-1.72	-0.84

Whole

Holding \ Formation	1	3	6	9	12
1	-0.54	-0.49	-1.31	-0.69	-2.72
3	-0.33	-0.72	-0.24	-1.61	-2.9
6	-0.64	-0.88	-1.03	-2.49	-2.87
9	-0.37	-1.33	-1.56	-2.41	-2.41
12	-0.65	-1.55	-1.46	-1.85	-1.67

Pairs =3

Before GFC

Holding \ Formation	1	3	6	9	12
1	-0.2	-2.38	-1.18	0.59	-2.73
3	-0.96	-1.2	-0.64	-0.39	-1.71
6	-0.88	-0.88	-0.99	-0.73	-1.54
9	-0.29	-0.51	-0.8	-1.16	-1.84
12	-0.43	-0.8	-0.96	-1.02	-1.78

After GFC

Holding \ Formation	1	3	6	9	12
1	-0.05	0.22	-3.18	-0.56	-2.56
3	0	-1.26	-2.15	-2.24	-3.17
6	-0.89	-2.31	-2.74	-2.97	-2.03
9	-1.24	-2.71	-2.76	-2.43	-1.04
12	-1.42	-2.52	-2.35	-1.62	-0.41

Whole

Holding \ Formation	1	3	6	9	12
1	-0.43	-0.18	-1.07	0.19	-1.6
3	-0.42	-0.7	-0.66	-1.09	-1.83
6	-0.74	-0.9	-1.2	-1.65	-1.76
9	-0.68	-1.09	-1.43	-1.71	-1.5
12	-0.83	-1.36	-1.31	-1.28	-0.96

GFC = Global Financial Crisis, holdout period of 1 June 2007 to 31 December 2007

Before GFC = 1 June 2002 to 31 May 2007, After GFC = 1 January 2008 to 28 June 2013

Table 5.1: Excess Returns vs. Changes in Speculative Open Interest Positions

		Before GFC				After GFC				Whole Period			
Formation	Lag	Open Long	t	Open Short	t	Open Long	t	Open Short	t	Open Long	t	Open Short	t
1	1	0.001893	0.81	-0.002019	-1.31	0.003964	2.22 *	-0.004281	-3.33 **	0.003359	2.32 *	-0.003554	-3.47 **
1	2	-0.002608	-1.02	0.000794	0.48	0.003332	1.56	0.002124	1.48	0.0026	1.49	0.00118	1.06
1	3	0.001622	0.65	-0.00084	-0.39	0.00243	0.95	0.002556	1.95	0.00278	1.35	0.001703	1.55
1	4	0.000655	0.25	0.000601	0.27	-0.002558	-1.43	0.002124	1.6	-0.00238	-1.58	0.001819	1.72
1	5	0.003723	1.29	-0.000348	-0.13	0.00306	1.36	-0.001376	-1	0.002949	1.61	-0.000762	-0.64
2	1	0.011315	4.97 **	-0.002728	-1.22	0.016971	8.33 **	-0.006583	-4.14 **	0.016183	9.73 **	-0.005915	-4.62 **
2	2	-0.000857	-0.33	-0.000962	-0.67	0.006783	2.55 *	0.001538	0.87	0.005701	2.61 **	0.00058	0.42
2	3	0.000766	0.29	-0.000403	-0.23	0.003081	0.94	0.005299	3.28 **	0.003073	1.16	0.003855	2.94 **
2	4	0.003209	1.06	0.000166	0.09	0.000182	0.07	0.003178	1.89	0.000474	0.22	0.002825	2.13 *
2	5	0.000263	0.09	-0.000839	-0.4	0.001642	0.64	-0.000659	-0.38	0.000767	0.37	0.000299	0.21
3	1	0.017135	7.64 **	-0.003444	-1.57	0.027239	11.86 **	-0.006811	-3.34 **	0.025908	13.48 **	-0.00603	-3.81 **
3	2	0.007895	3.12 **	-0.001803	-1.07	0.01501	4.84 **	0.000539	0.24	0.014005	5.53 **	-0.000416	-0.24
3	3	0.00212	0.72	-0.000987	-0.55	0.005948	1.59	0.004944	2.31 *	0.005384	1.78	0.003515	2.03 *
3	4	0.000378	0.11	-0.000605	-0.29	0.00275	0.74	0.004586	2.13 *	0.002094	0.7	0.003992	2.32 *
3	5	-0.000991	-0.31	-0.000699	-0.33	0.002967	0.98	0.000762	0.35	0.001598	0.64	0.001325	0.76
4	1	0.01819	7.39 **	-0.004375	-2.06 *	0.033619	11.74 **	-0.00767	-3.13 **	0.031511	13.15 **	-0.006853	-3.65 **
4	2	0.013367	4.83 **	-0.002559	-1.13	0.024027	6.48 **	-0.000422	-0.15	0.022555	7.43 **	-0.00112	-0.53
4	3	0.006483	1.99 *	-0.001967	-0.86	0.013397	3.12 **	0.003277	1.23	0.012255	3.52 **	0.002204	1.03
4	4	-0.000754	-0.22	-0.00132	-0.65	0.005621	1.34	0.004325	1.6	0.003959	1.16	0.003518	1.67
4	5	-0.002671	-0.81	-0.000245	-0.11	0.005412	1.48	0.00225	0.83	0.003433	1.15	0.002448	1.17
5	1	0.019837	6.87 **	-0.005288	-2.13 *	0.038756	11.34 **	-0.008409	-3.04 **	0.036119	12.56 **	-0.0076	-3.59 **
5	2	0.014037	4.33 **	-0.003747	-1.62	0.031366	7.22 **	-0.002717	-0.89	0.02885	8.07 **	-0.002762	-1.18
5	3	0.009816	2.7 **	-0.002411	-1.02	0.022123	4.75 **	0.001697	0.56	0.020005	5.26 **	0.000957	0.4
5	4	0.003468	0.88	-0.001174	-0.53	0.013002	2.9 **	0.002732	0.9	0.010767	2.95 **	0.002233	0.97
5	5	-0.002914	-0.8	-0.001331	-0.61	0.007803	1.83	0.002601	0.86	0.005263	1.51	0.002409	1.07

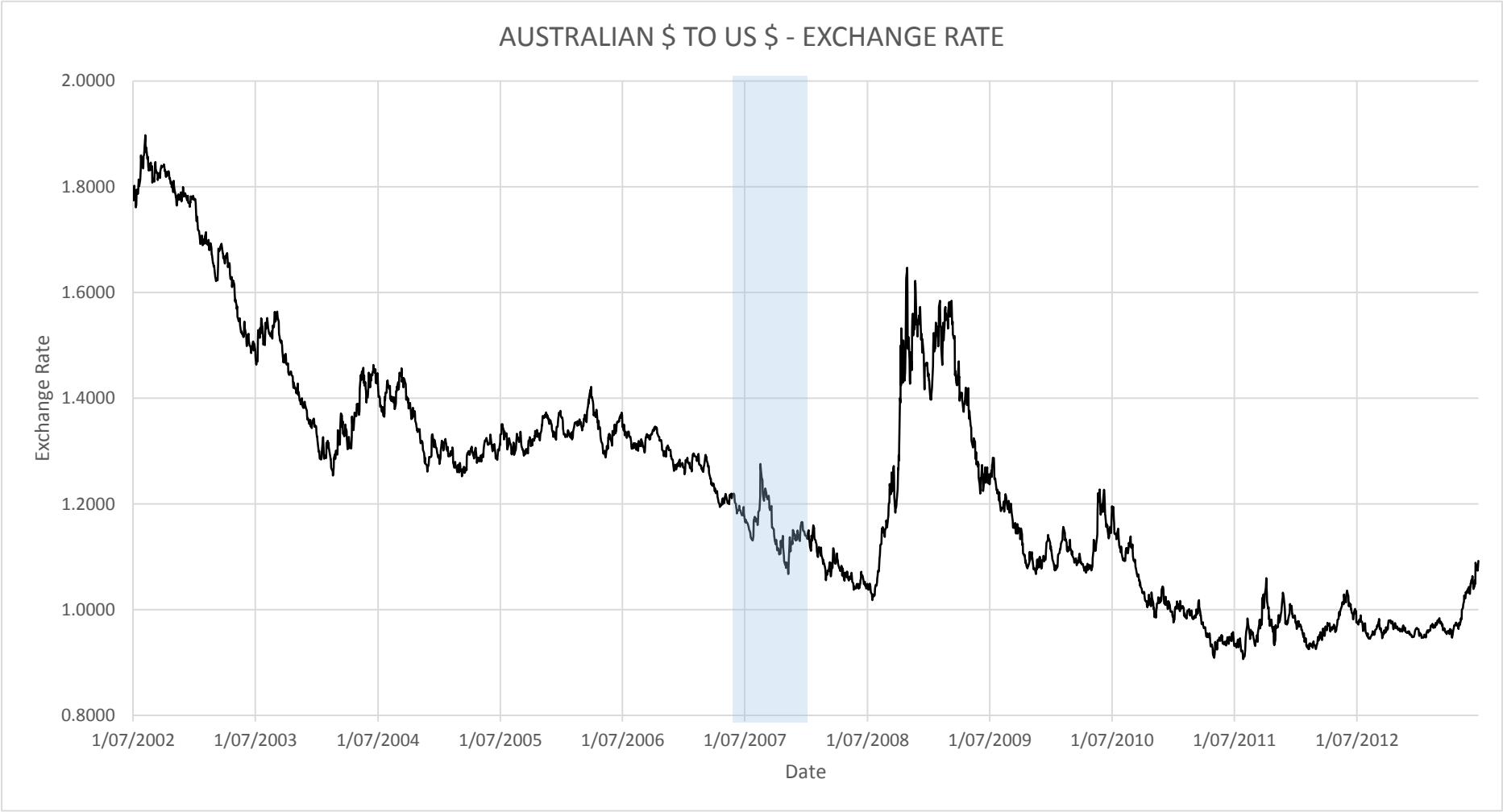
Regression results comparing excess returns from exchange rate movements with lagged changes in the quantities of open interest contracts either long or short a currency pair.
** Denotes significance at the 1% level, while * denotes significance at the 5% level.

Table 5.2: Spot Returns vs. Changes in Speculative Open Interest Positions

		Before GFC				After GFC				Whole Period			
Formation	Lag	Open Long	t	Open Short	t	Open Long	t	Open Short	t	Open Long	t	Open Short	t
1	1	0.001902	0.82	-0.002023	-1.32	0.004004	2.24 *	-0.004296	-3.34 **	0.00341	2.35 *	-0.003564	-3.47 **
1	2	-0.002597	-1.02	0.000789	0.48	0.003371	1.58	0.002107	1.47	0.002645	1.52	0.001169	1.05
1	3	0.001624	0.66	-0.000847	-0.39	0.002453	0.96	0.00255	1.94	0.002809	1.36	0.001696	1.54
1	4	0.000659	0.25	0.000596	0.27	-0.002541	-1.41	0.002118	1.6	-0.002352	-1.56	0.001813	1.71
1	5	0.00373	1.3	-0.000353	-0.14	0.003083	1.36	-0.00138	-1.01	0.002982	1.62	-0.000763	-0.64
2	1	0.011333	4.98 **	-0.002741	-1.23	0.017054	8.33 **	-0.006616	-4.15 **	0.016282	9.74 **	-0.005938	-4.63 **
2	2	-0.000843	-0.33	-0.000973	-0.67	0.006851	2.57 *	0.001514	0.85	0.005785	2.65 **	0.000562	0.4
2	3	0.000776	0.29	-0.000415	-0.24	0.003131	0.95	0.005285	3.26 **	0.003137	1.18	0.00384	2.92 **
2	4	0.003217	1.06	0.000154	0.08	0.000222	0.08	0.00317	1.88	0.000532	0.25	0.002817	2.12 *
2	5	0.000272	0.09	-0.000845	-0.41	0.001703	0.66	-0.000666	-0.39	0.000841	0.4	0.000295	0.21
3	1	0.017158	7.64 **	-0.003463	-1.58	0.027345	11.82 **	-0.006859	-3.35 **	0.02604	13.45 **	-0.006064	-3.82 **
3	2	0.007913	3.13 **	-0.001824	-1.09	0.01511	4.85 **	0.000504	0.23	0.014127	5.55 **	-0.000444	-0.26
3	3	0.002135	0.72	-0.001006	-0.56	0.006028	1.6	0.004924	2.29 *	0.005486	1.8	0.003495	2.01 *
3	4	0.000392	0.12	-0.000619	-0.3	0.002831	0.76	0.004574	2.11 *	0.002194	0.73	0.003979	2.3 *
3	5	-0.000978	-0.3	-0.000708	-0.33	0.003069	1	0.000756	0.34	0.001715	0.68	0.001319	0.75
4	1	0.018212	7.4 **	-0.004398	-2.08 *	0.033748	11.69 **	-0.007738	-3.14 **	0.031677	13.09 **	-0.006896	-3.65 **
4	2	0.013386	4.84 **	-0.002584	-1.15	0.024151	6.48 **	-0.000474	-0.17	0.022711	7.43 **	-0.001155	-0.54
4	3	0.006496	1.99 *	-0.001991	-0.87	0.01352	3.13 **	0.003245	1.21	0.012404	3.54 **	0.00218	1.01
4	4	-0.000742	-0.21	-0.001335	-0.66	0.005748	1.36	0.004306	1.59	0.004108	1.2	0.003505	1.65
4	5	-0.002658	-0.81	-0.000252	-0.11	0.00556	1.5	0.002238	0.81	0.003599	1.19	0.002443	1.16
5	1	0.019854	6.88 **	-0.005312	-2.15 *	0.038913	11.27 **	-0.008495	-3.05 **	0.036324	12.48 **	-0.00765	-3.58 **
5	2	0.014053	4.34 **	-0.003773	-1.64	0.031527	7.2 **	-0.002786	-0.9	0.029051	8.04 **	-0.002803	-1.19
5	3	0.00983	2.71 **	-0.002435	-1.03	0.022291	4.75 **	0.00165	0.54	0.020204	5.26 **	0.000928	0.38
5	4	0.003475	0.88	-0.001192	-0.53	0.013185	2.91 **	0.002702	0.88	0.010975	2.97 **	0.002217	0.95
5	5	-0.002909	-0.8	-0.001339	-0.61	0.008007	1.85	0.002583	0.85	0.005487	1.55	0.002405	1.06

Regression results comparing spot returns from exchange rate movements with lagged changes in the quantities of open interest contracts either long or short a currency pair.
** Denotes significance at the 1% level, while * denotes significance at the 5% level.

Chart 1.1: AUD/USD Exchange Rate (June 2002 to July 2013)



Note: Blue shading denotes Global Financial Crisis period (1/6/2007 – 31/12/2007)

Chart 1.2: CAD/USD Exchange Rate (June 2002 to July 2013)

Chart 1.3: CZK/USD Exchange Rate (June 2002 to July 2013)

Chart 1.4: DKK/USD Exchange Rate (June 2002 to July 2013)

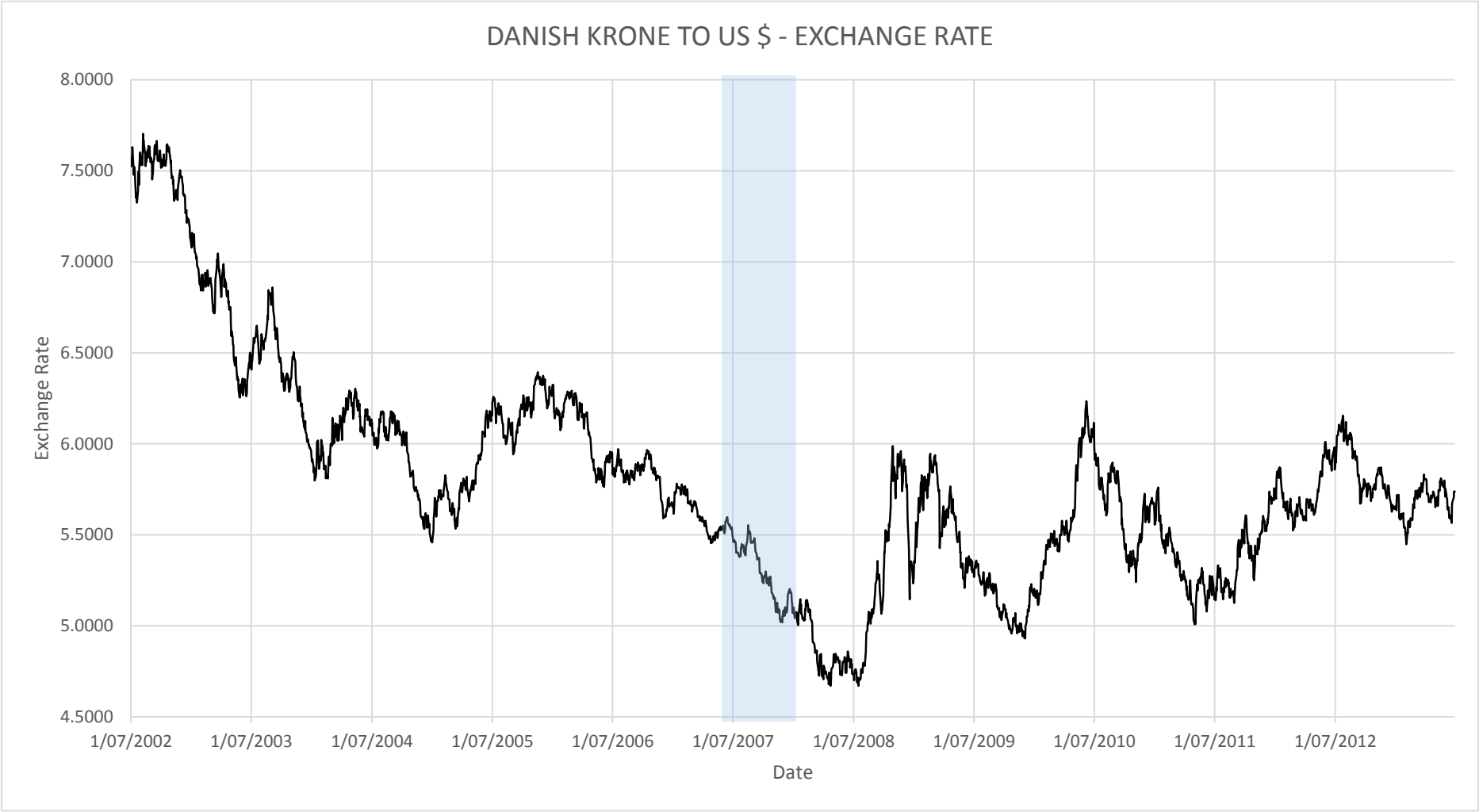


Chart 1.5: EUR/USD Exchange Rate (June 2002 to July 2013)

Chart 1.6: HKD/USD Exchange Rate (June 2002 to July 2013)

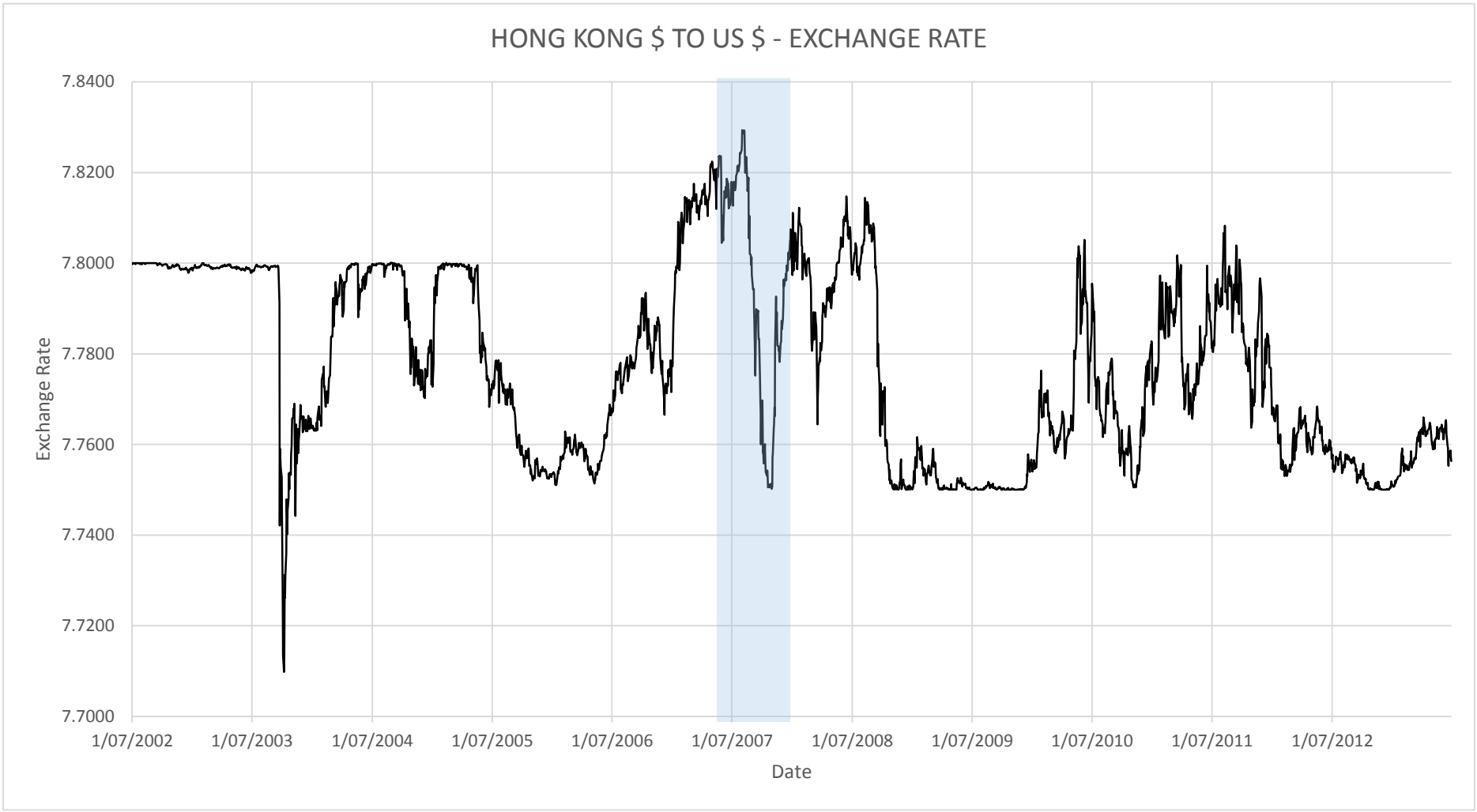


Chart 1.7: HUF/USD Exchange Rate (June 2002 to July 2013)

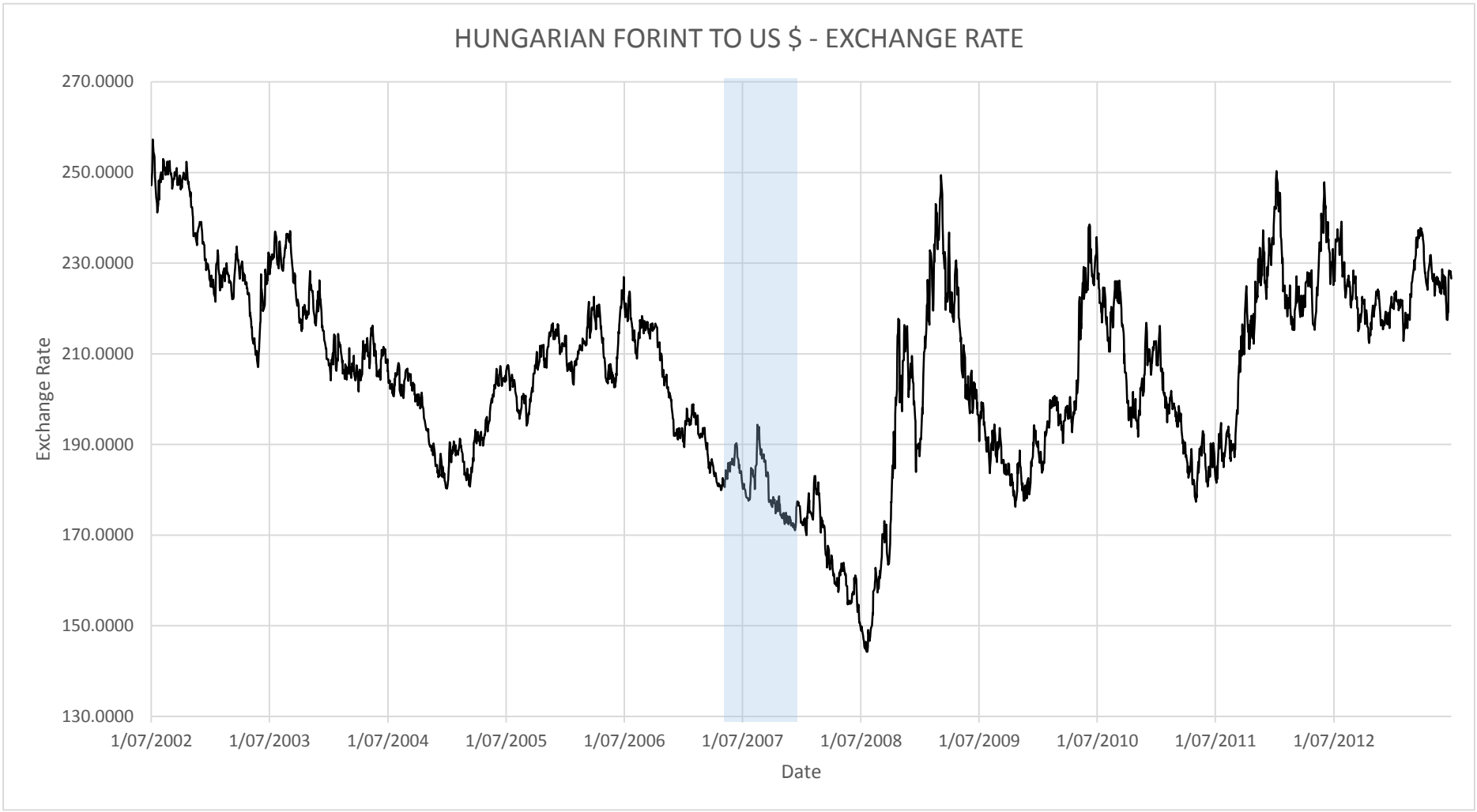


Chart 1.8: JPY/USD Exchange Rate (June 2002 to July 2013)

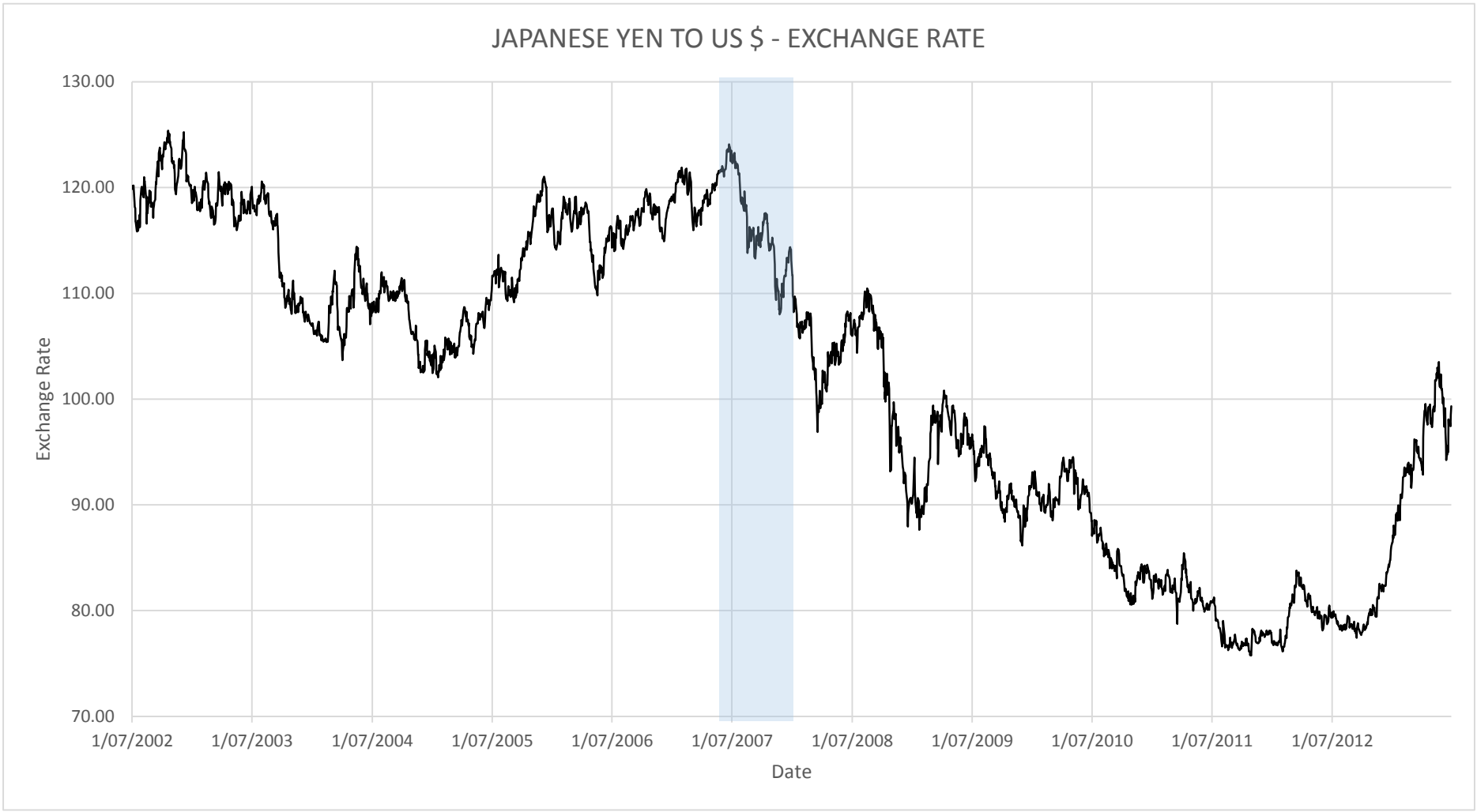


Chart 1.9: MXN/USD Exchange Rate (June 2002 to July 2013)

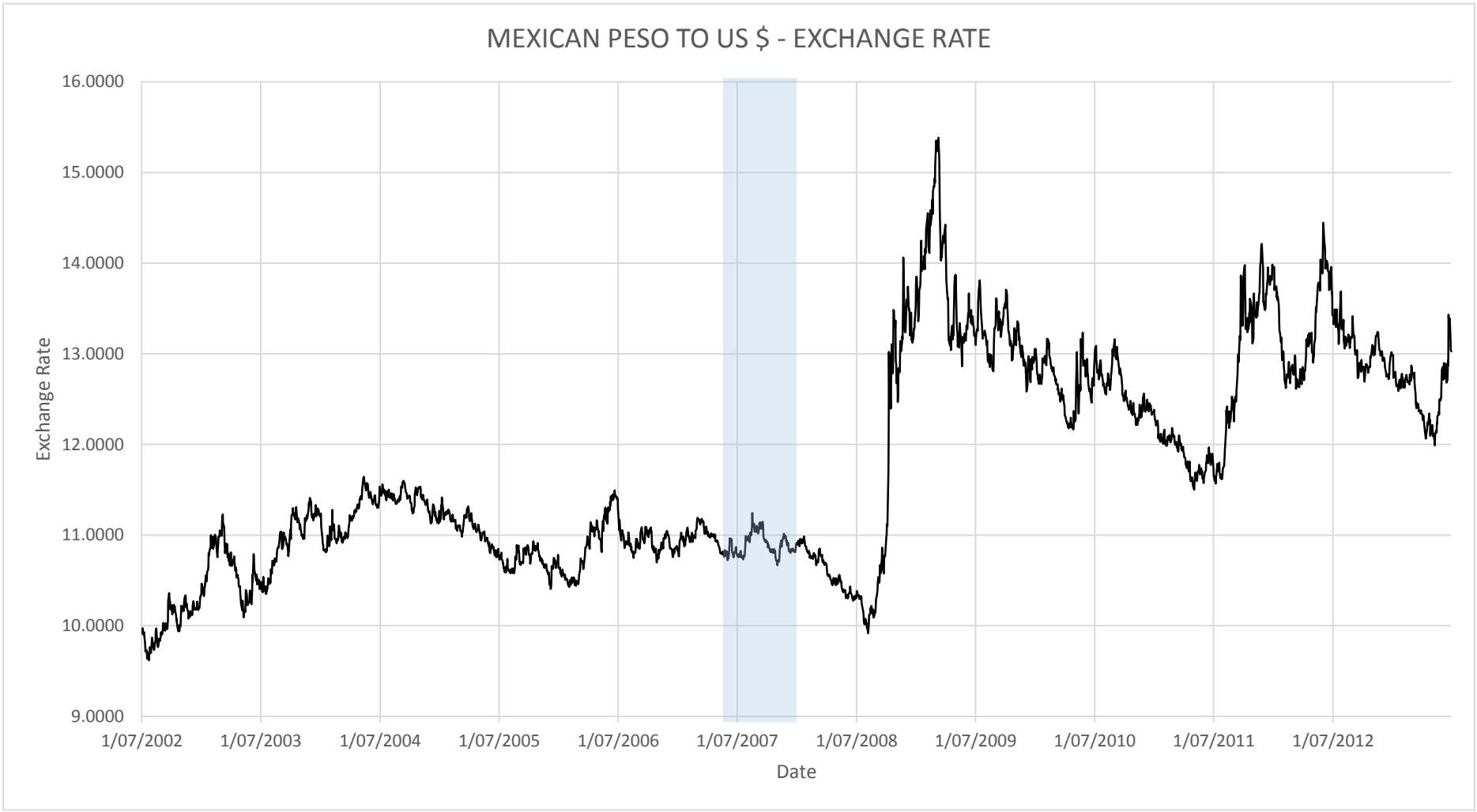


Chart 1.10: TRY/USD Exchange Rate (June 2002 to July 2013)

Chart 1.11: NZD/USD Exchange Rate (June 2002 to July 2013)

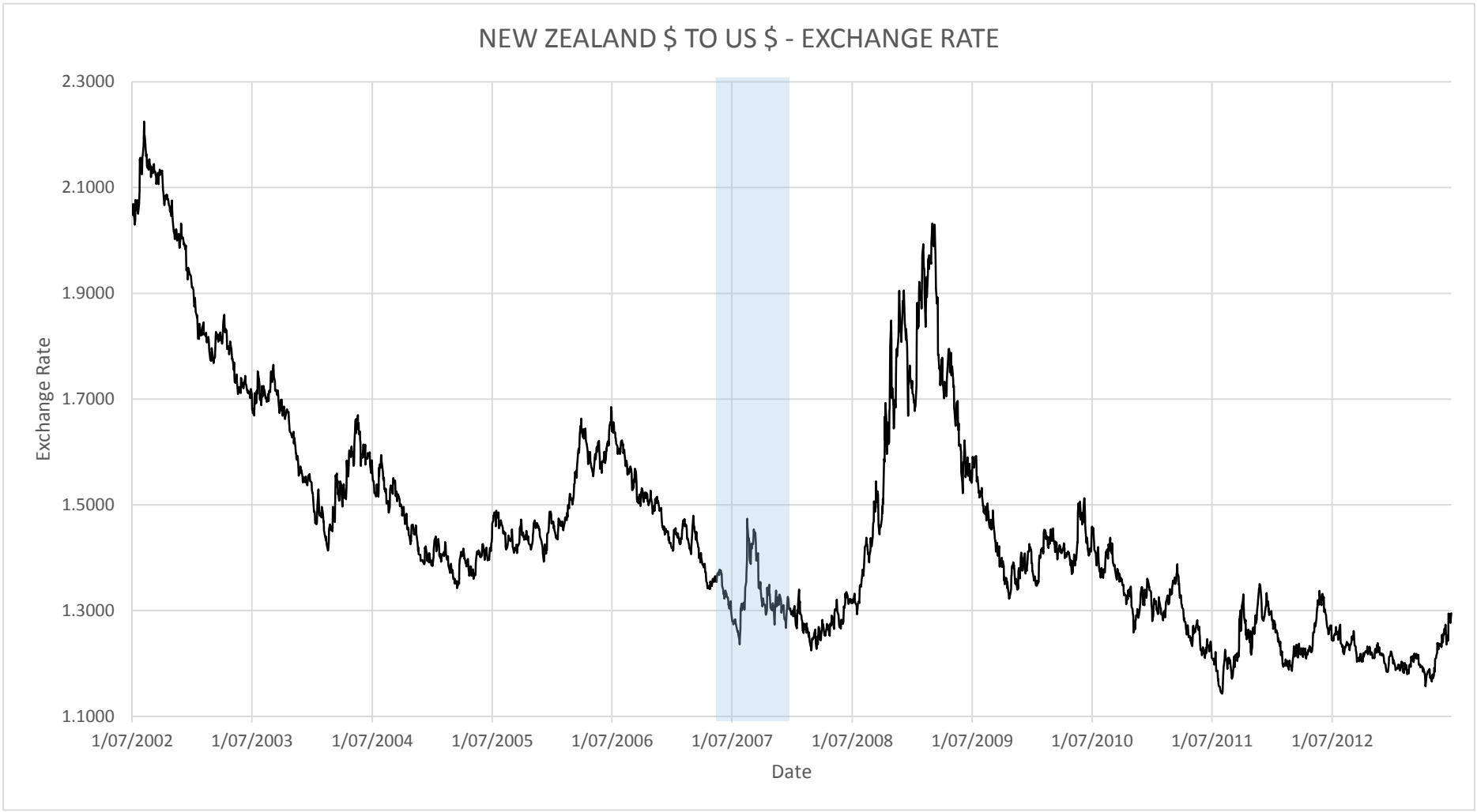


Chart 1.12: NOK/USD Exchange Rate (June 2002 to July 2013)

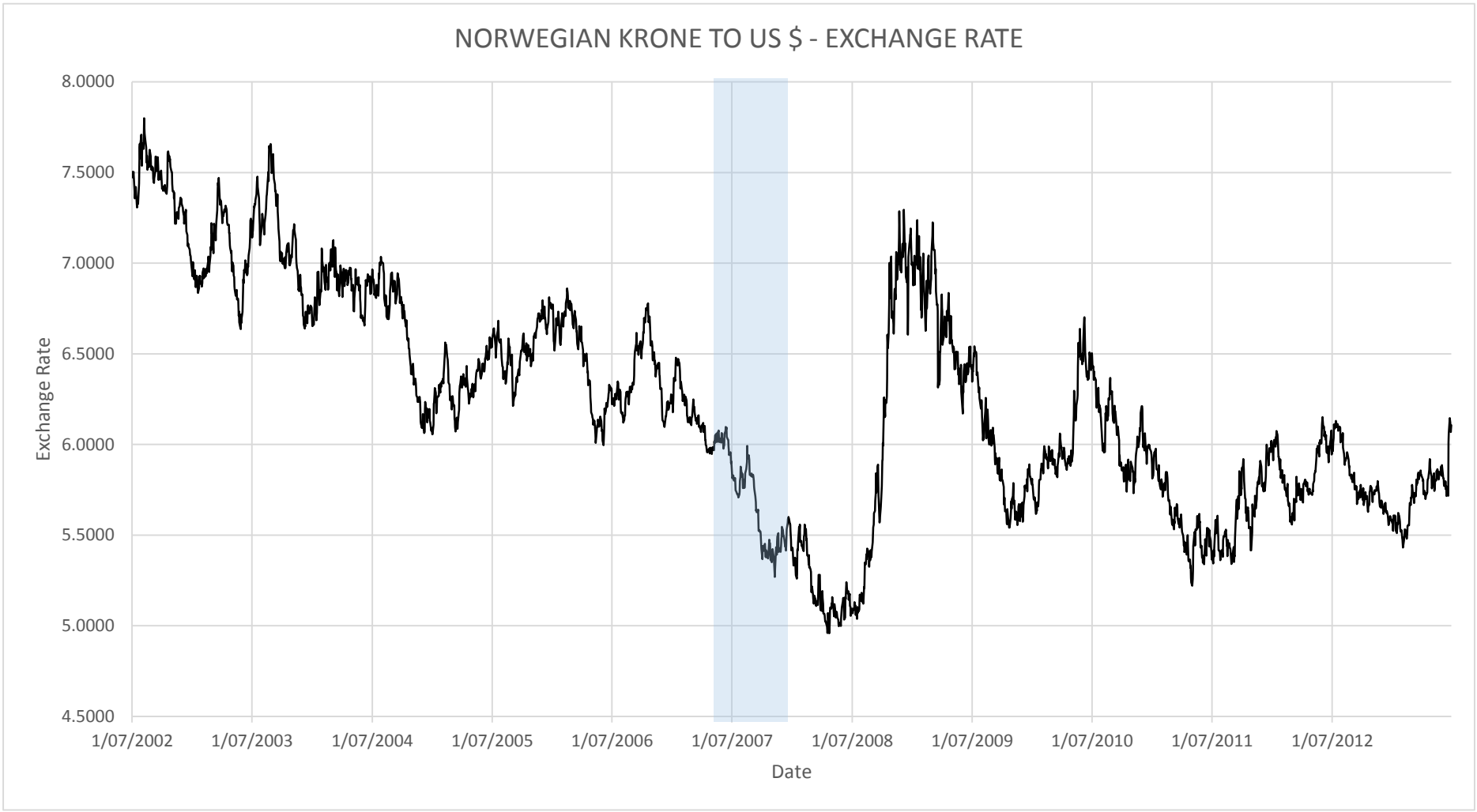


Chart 1.13: PLN/USD Exchange Rate (June 2002 to July 2013)

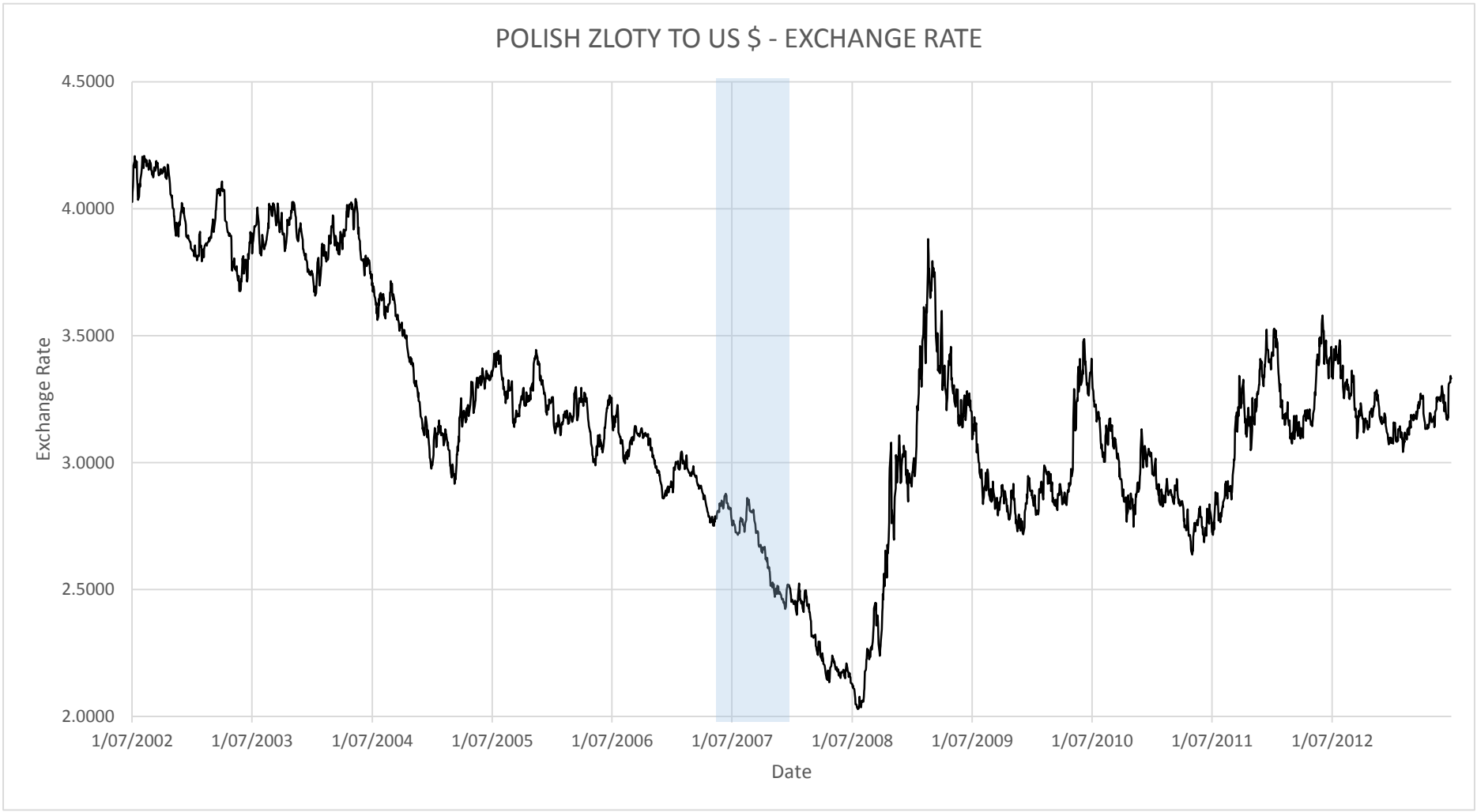


Chart 1.14: SGD/USD Exchange Rate (June 2002 to July 2013)

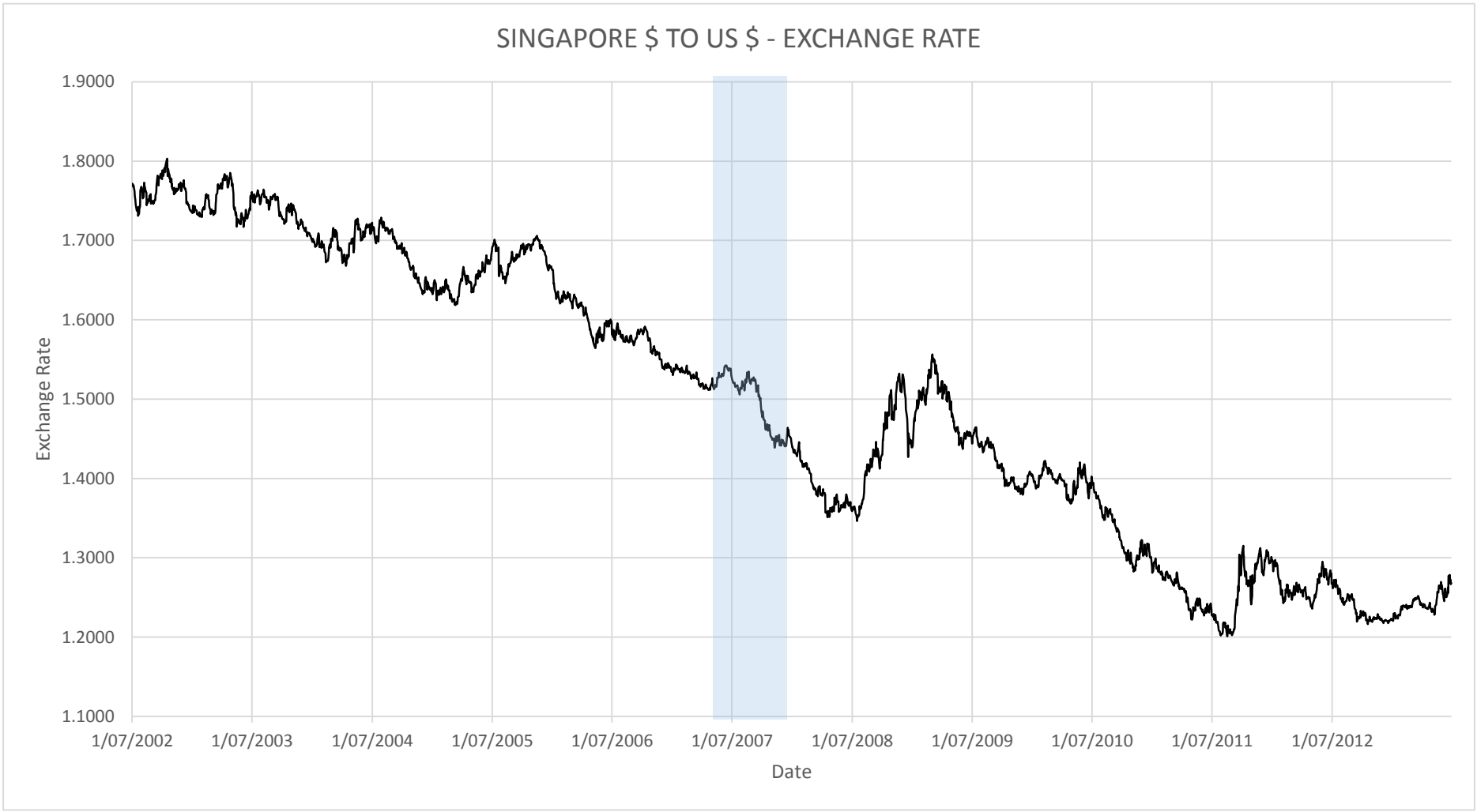


Chart 1.15: ZAR/USD Exchange Rate (June 2002 to July 2013)

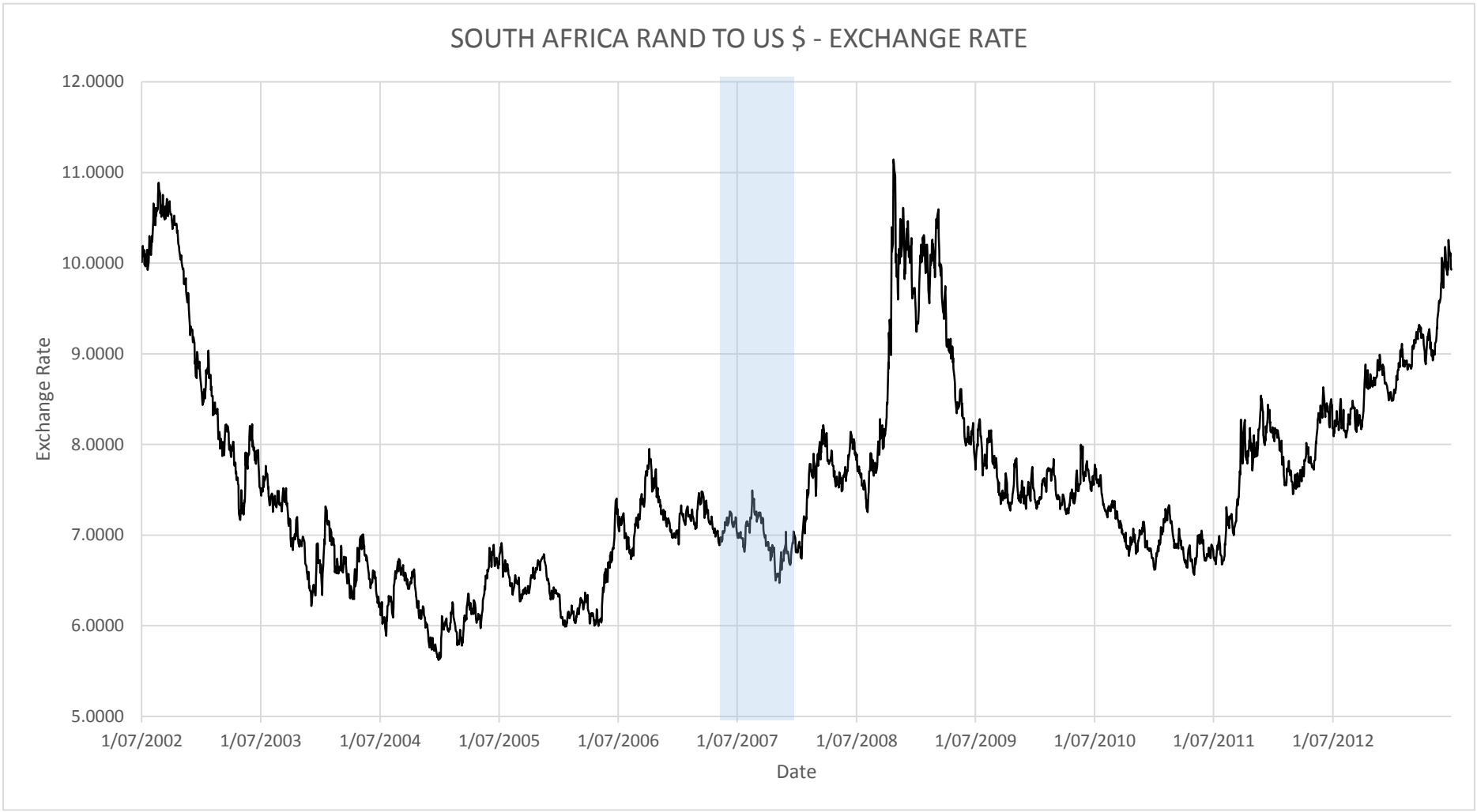


Chart 1.16: SEK/USD Exchange Rate (June 2002 to July 2013)

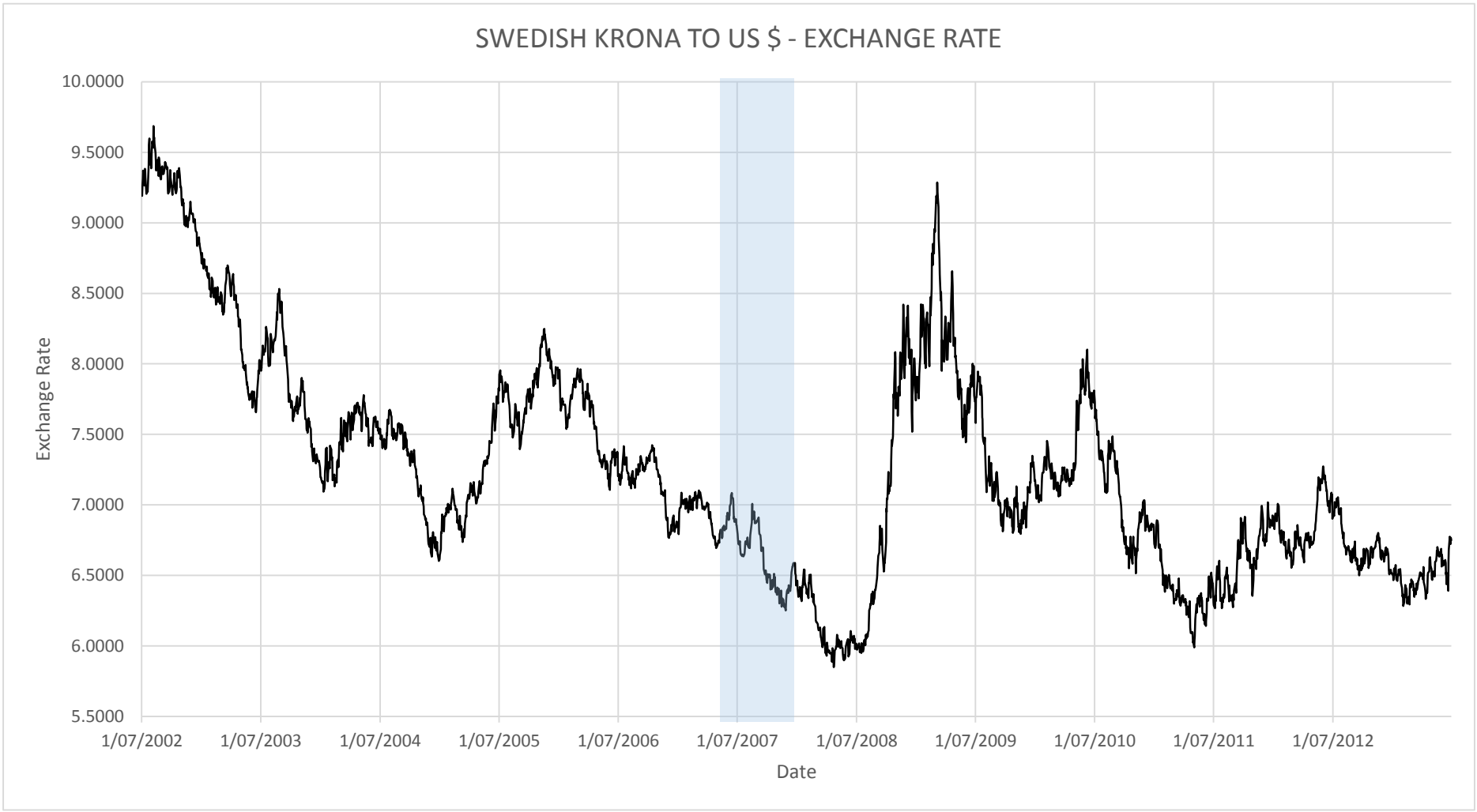


Chart 1.17: CHF/USD Exchange Rate (June 2002 to July 2013)

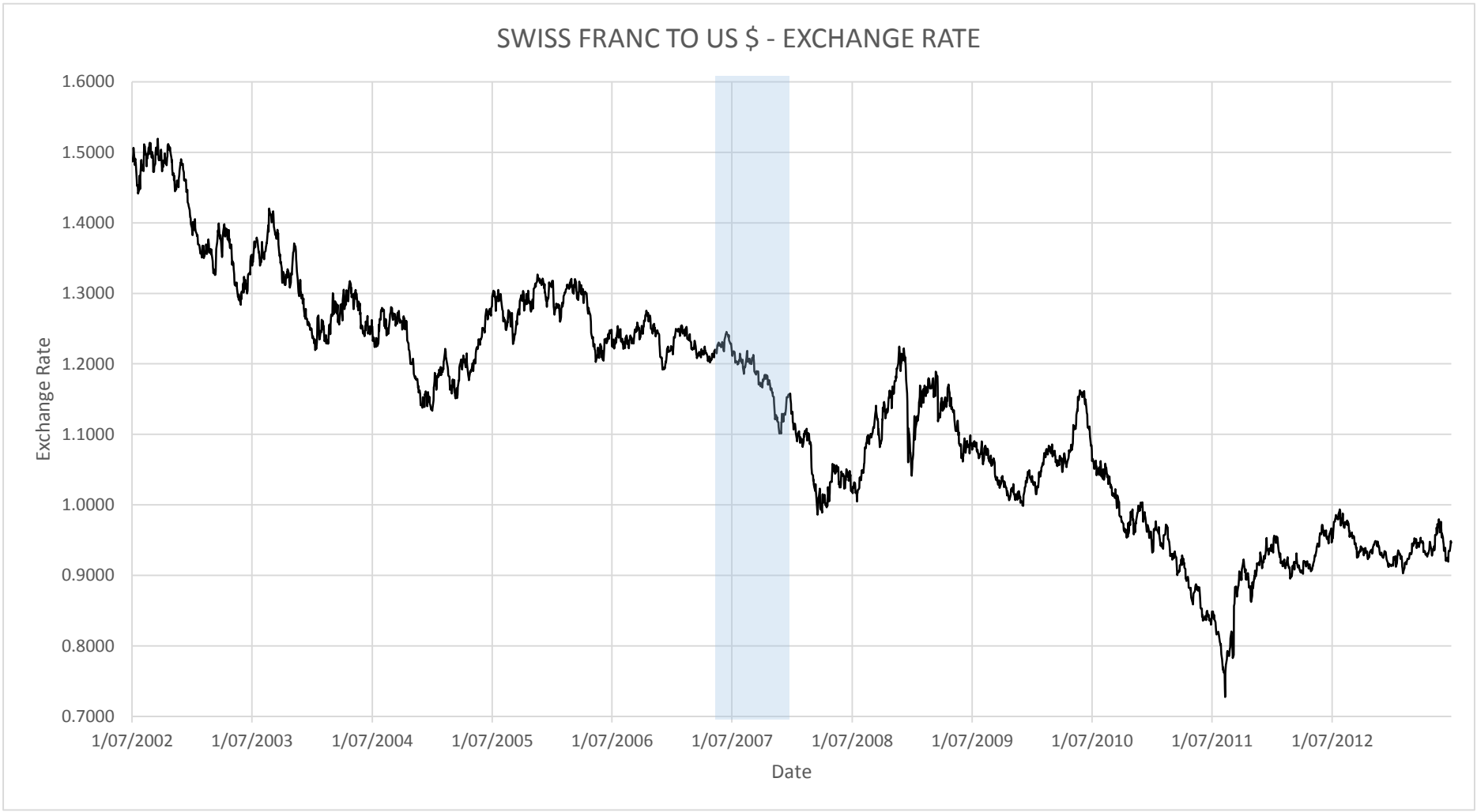


Chart 1.18: GBP/USD Exchange Rate (June 2002 to July 2013)

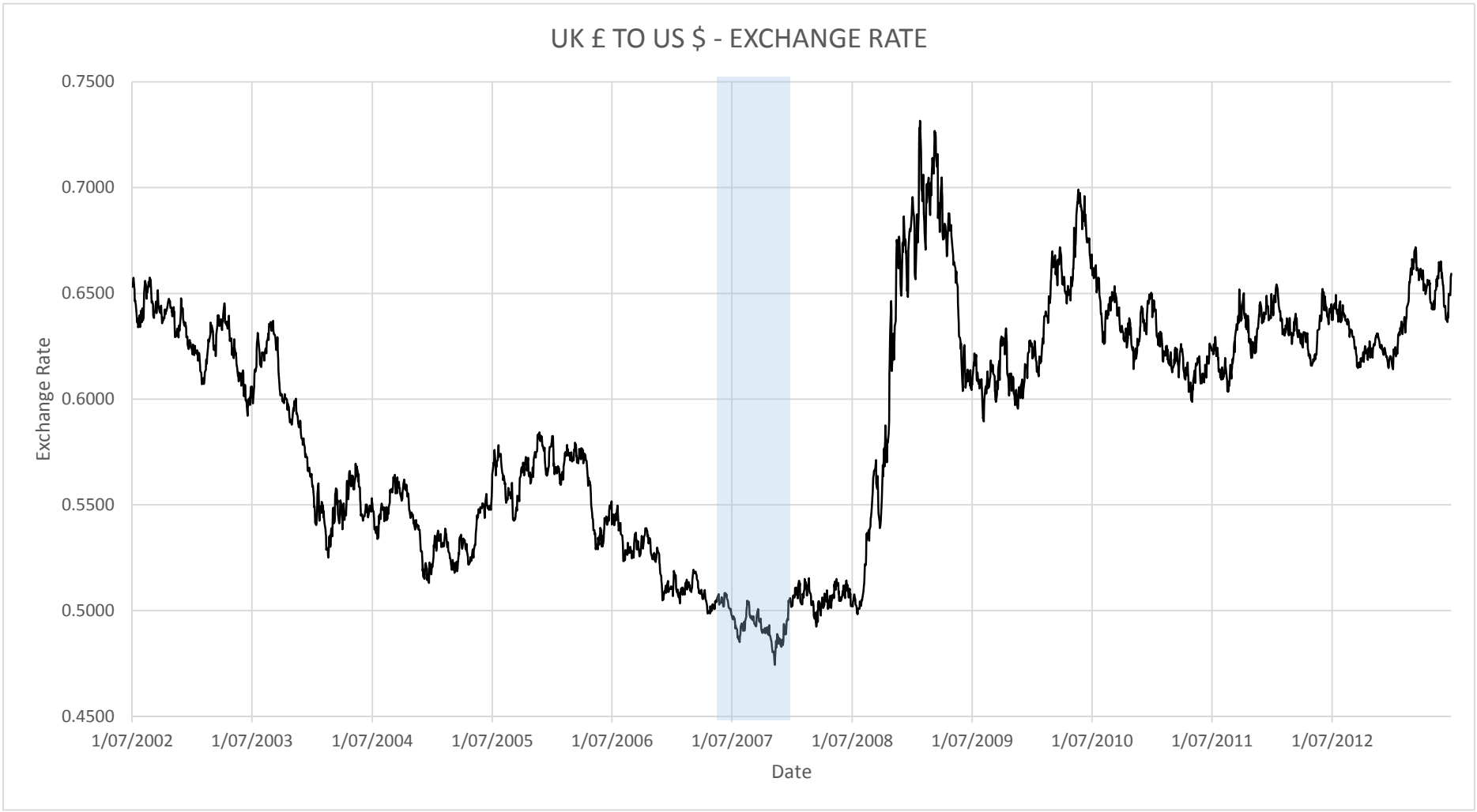


Chart 2.1: AUD/USD - Exchange Rate, Open Interest, and Net Trader Positioning

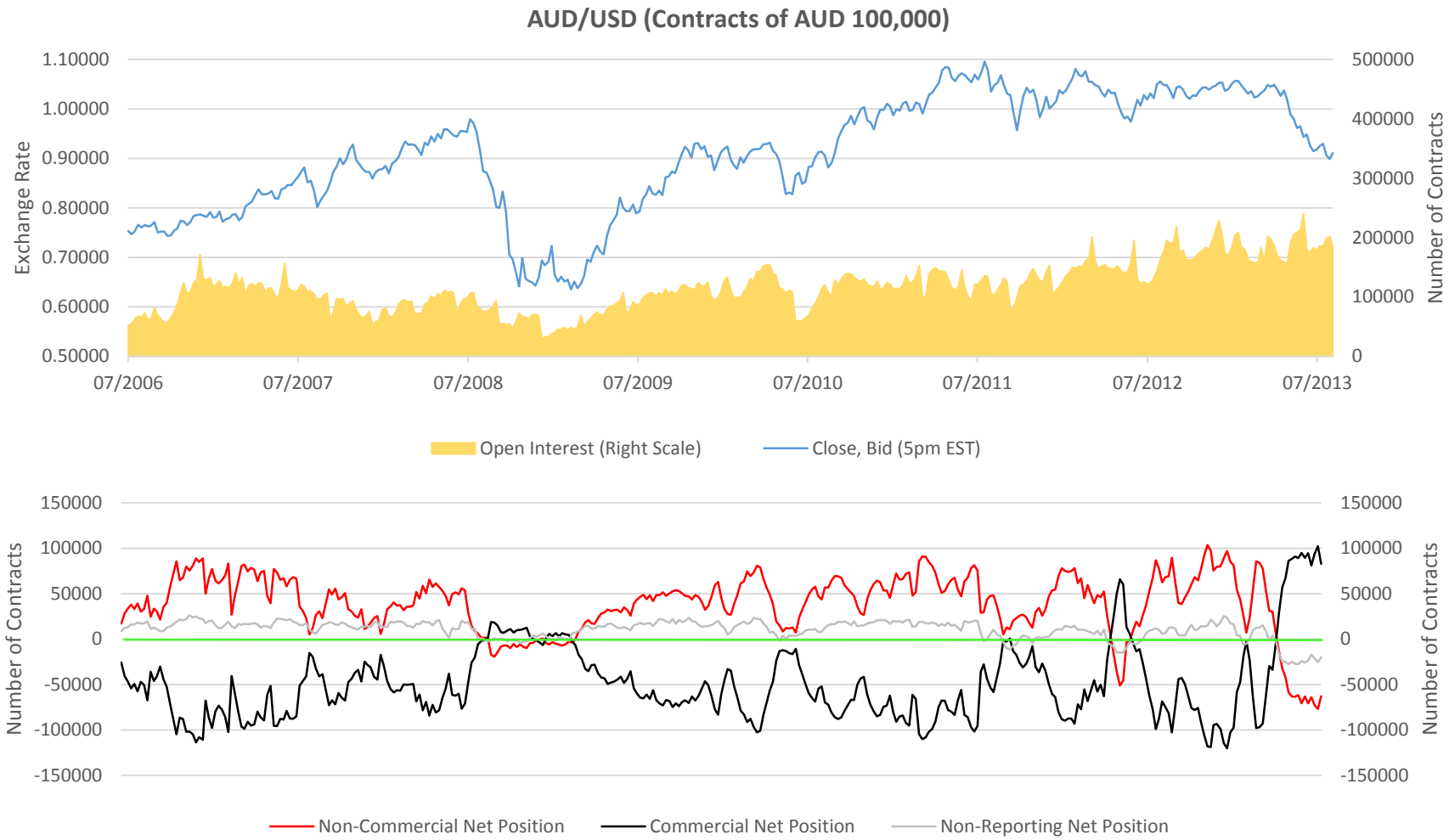


Chart 2.2: USD/CAD - Exchange Rate, Open Interest, and Net Trader Positioning

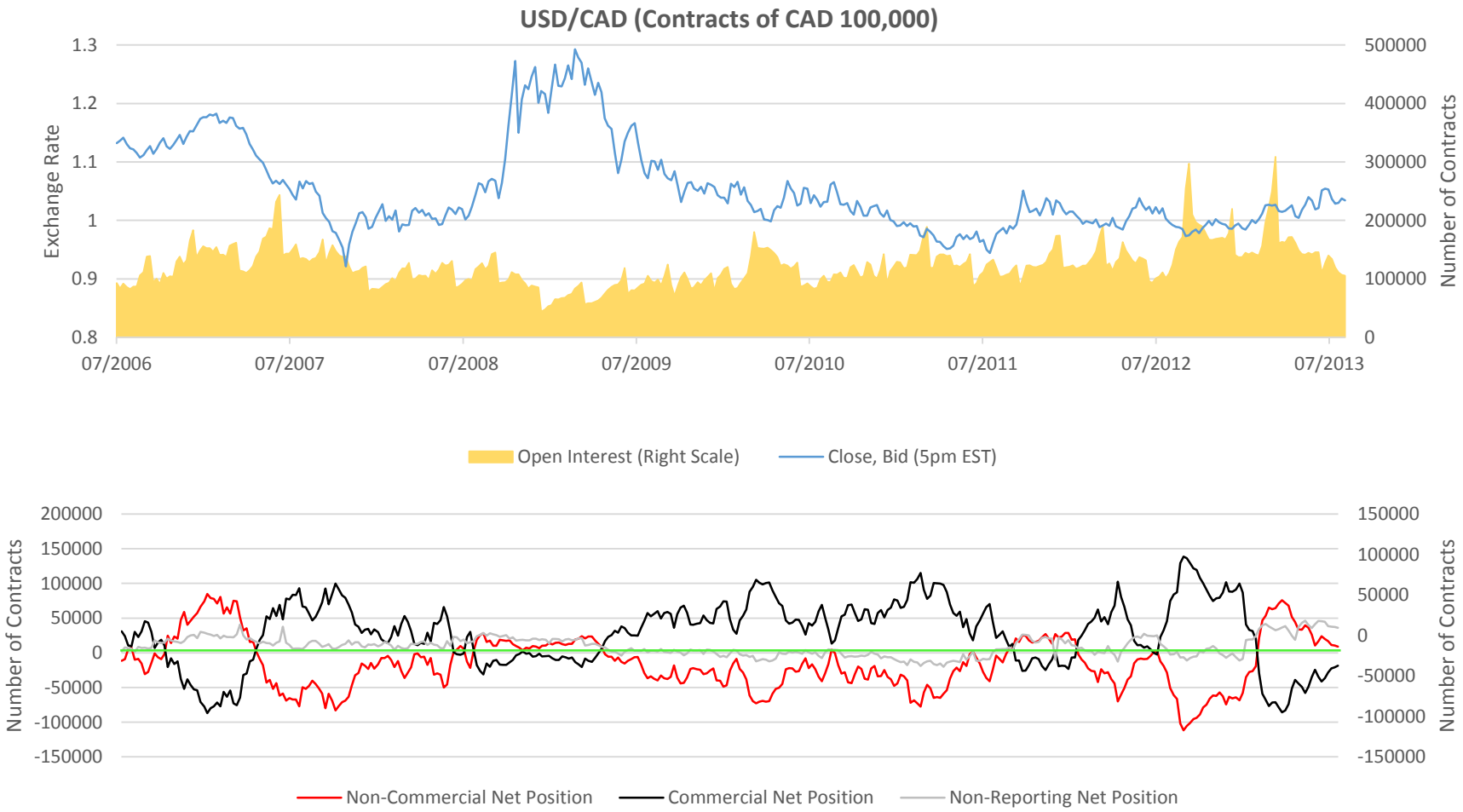


Chart 2.3: USD/CHF - Exchange Rate, Open Interest, and Net Trader Positioning

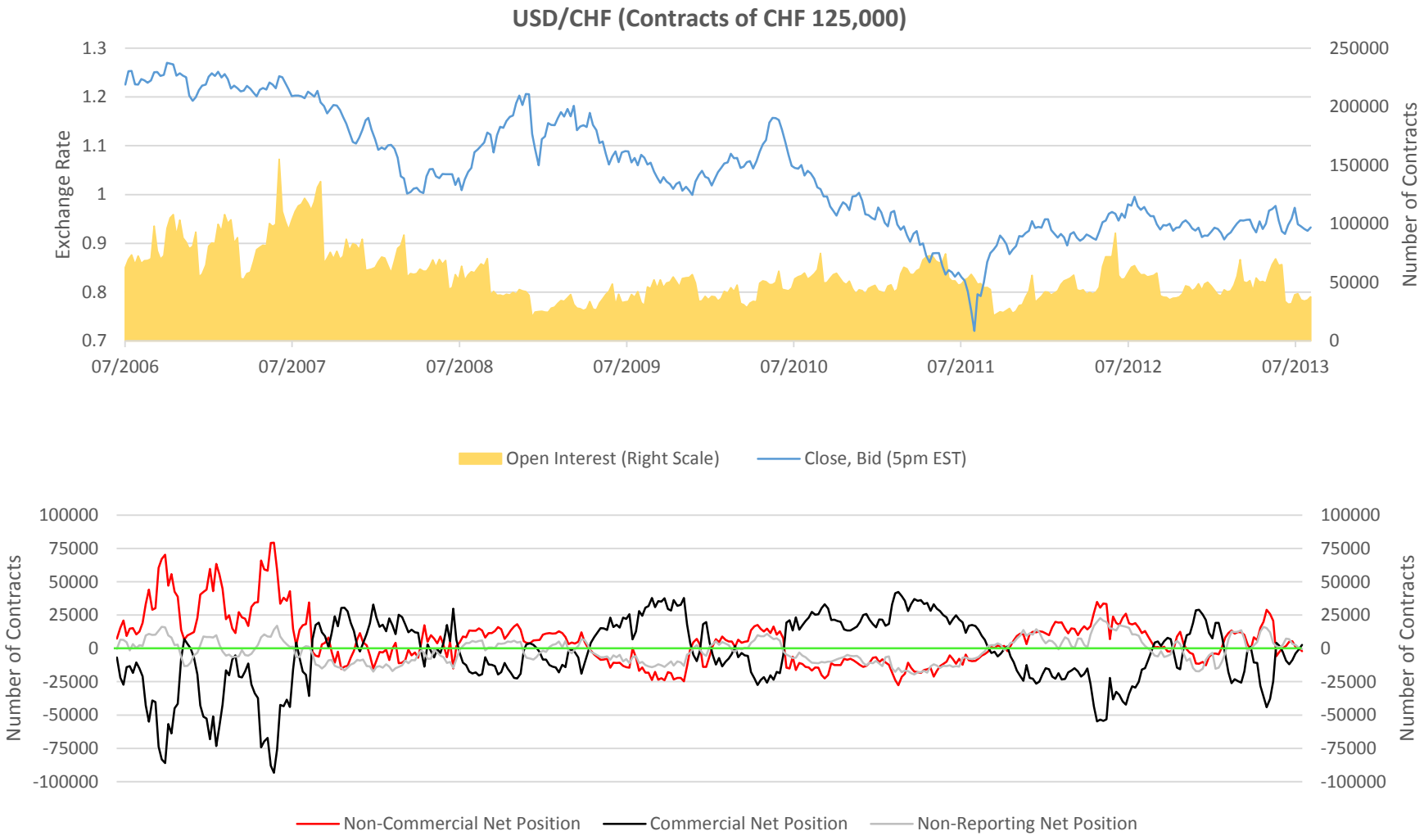


Chart 2.4: EUR/USD - Exchange Rate, Open Interest, and Net Trader Positioning

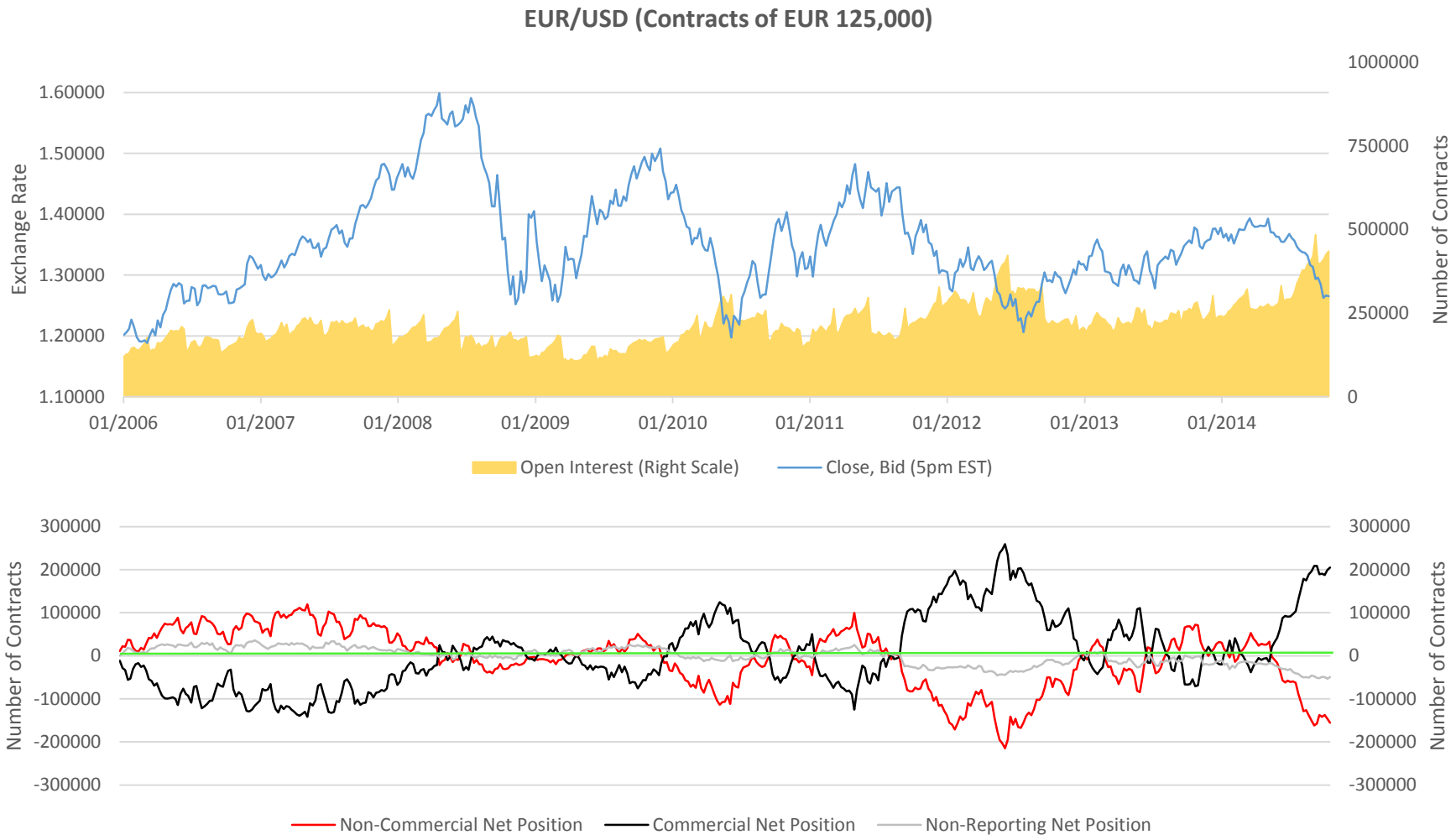


Chart 2.5: GBP/USD - Exchange Rate, Open Interest, and Net Trader Positioning

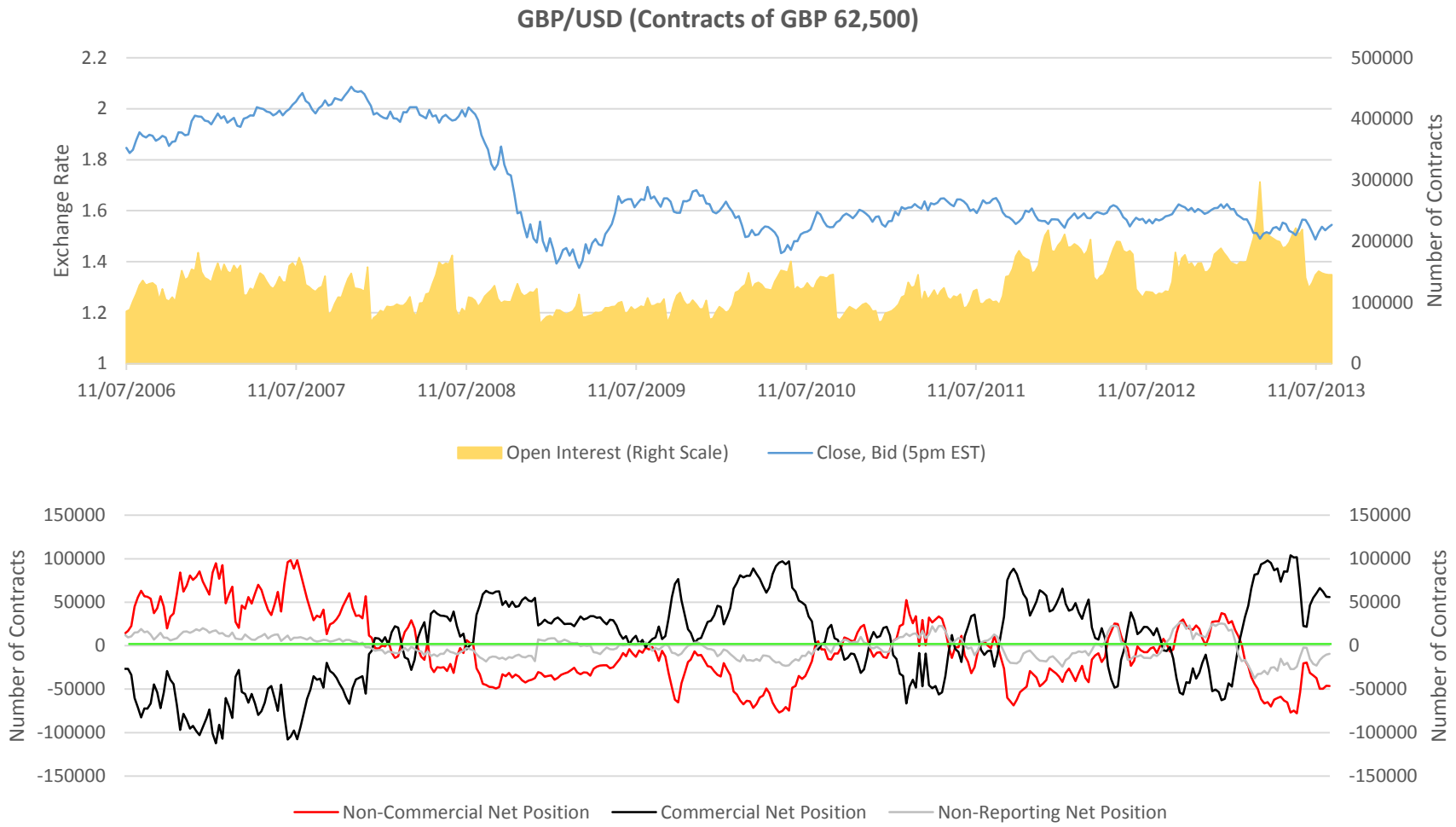


Chart 2.6: USD/JPY - Exchange Rate, Open Interest, and Net Trader Positioning

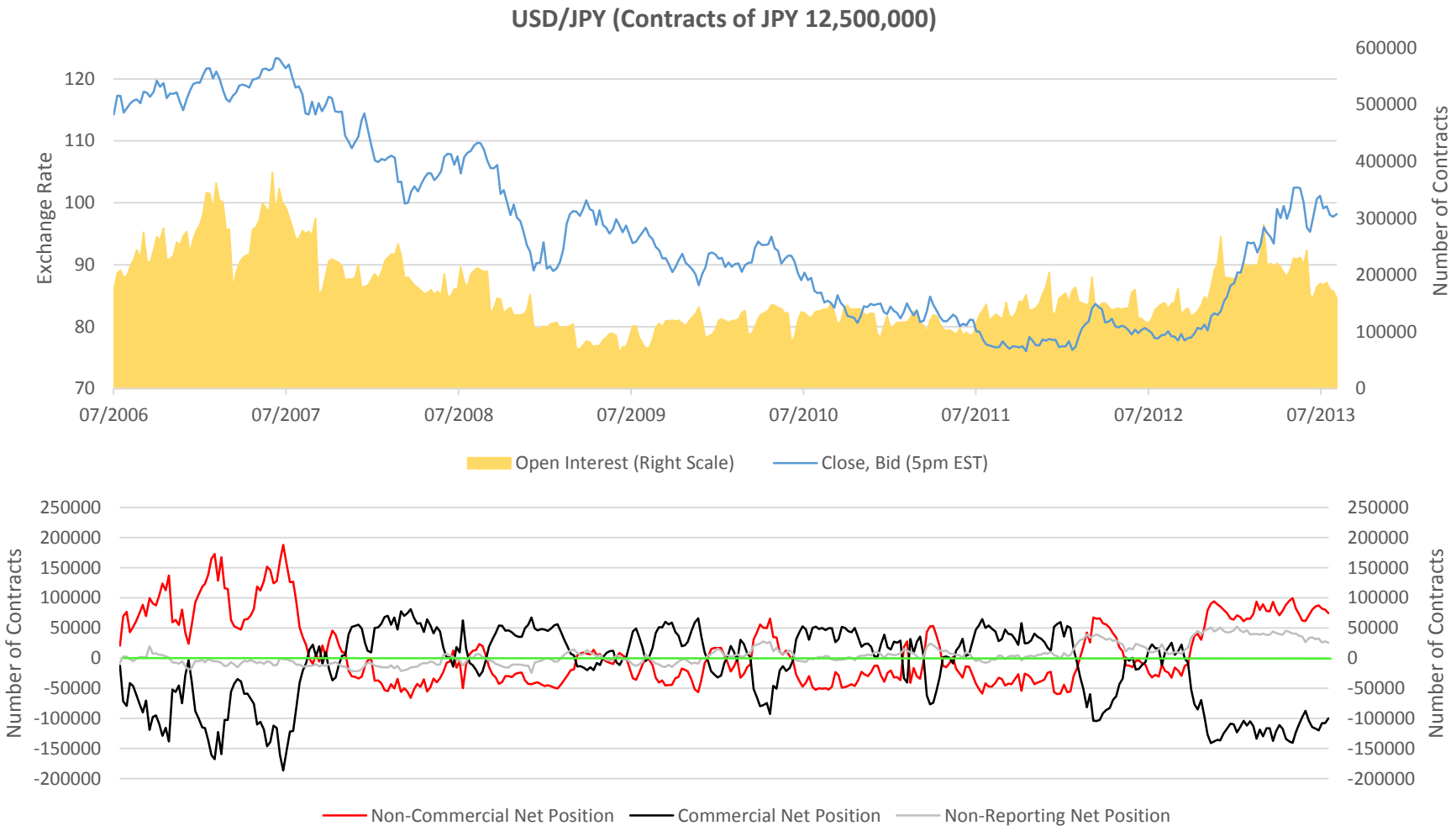


Chart 2.7: USD/MXN - Exchange Rate, Open Interest, and Net Trader Positioning

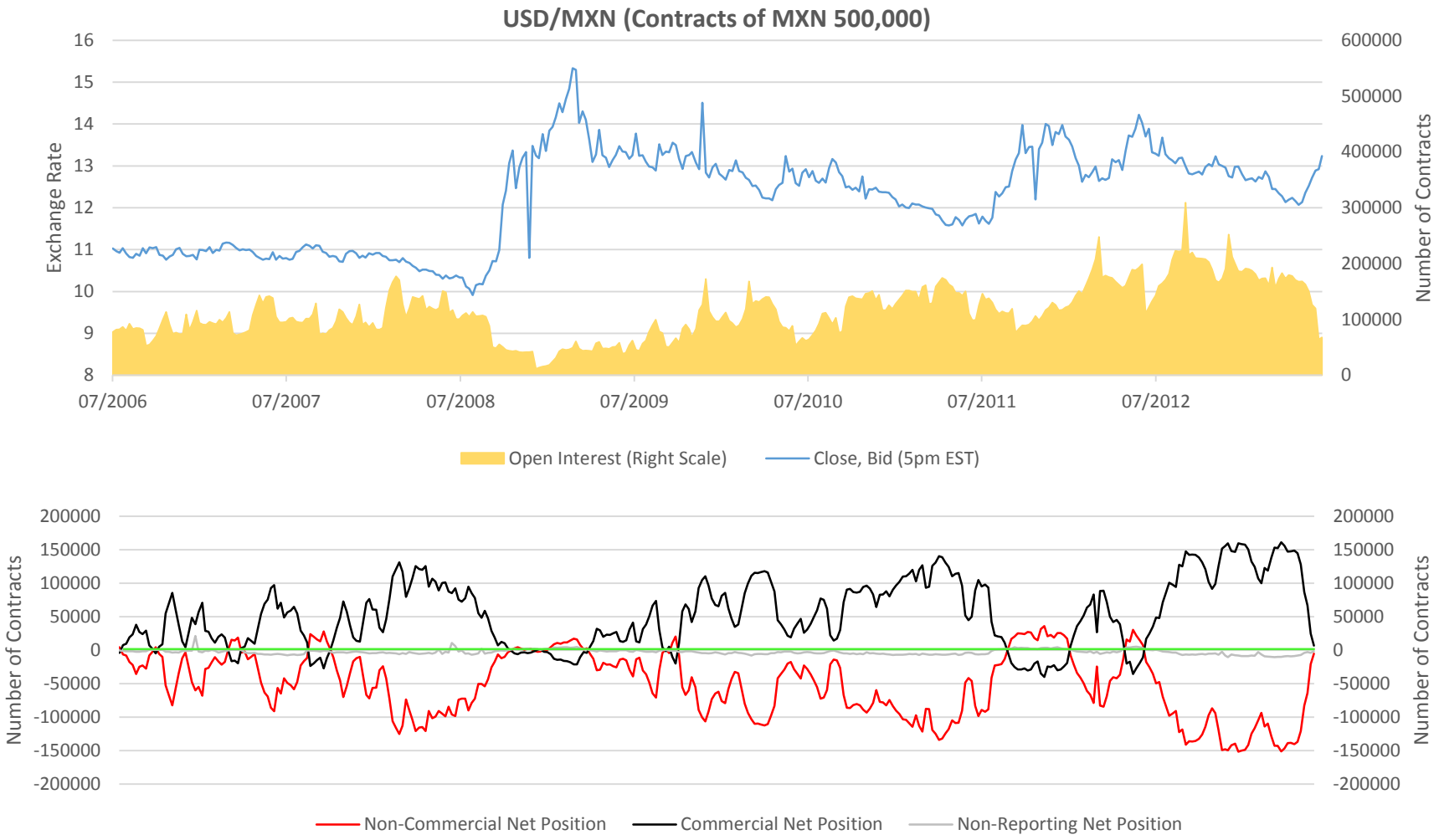


Chart 2.8: NZD/USD - Exchange Rate, Open Interest, and Net Trader Positioning